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April 30, May 1 and 2, 1928

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THE AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

FIRST DAY, APRIL 30, 1928

LEIOMYOMA OF THE KIDNEY

REPORT OF A CASE

HENRY G. BUGBEE

New York

This case is reported because of the rarity of the lesion, interesting points in the diagnosis, and as demonstrating the value of an exploration of all renal tumors.

THE RARITY OF THE PATHOLOGICAL LESION

No report of a case in a living patient was found in a search of the literature made through the Index Catalogue of the Surgeon General's Library, various text books, and articles on renal tumors. A report was found of two cases found at autopsy. An abstract of this report[1] is as follows:

The two cases of multiple tumors of the kidney which we report were accidental autopsy finds. They both occurred in women about thirty-five years of age, who died of pneumonia. Both patients showed chronic inflammatory lesions of the tubes and ovaries. The right kidney in each each case presented evidences of slight parenchymatous nephritis.

The left kidney was involved in the neoplasm in each case. They showed many microscopic and macroscopic features in common.

The fatty capsule was moderate in amount. The fibrous capsule stripped off with moderate ease. But on the first kidney the capsule was intimately adherent in places corresponding to the location of the small

[1] Lartigan, August Jerome, and Larkin, John H.; Multiple leiomyomata of the kidney. A study of two cases. Jour. of Med. Research, 1901, No. 1, (abstract), 1 illustration.

subcapsular myomatous nodules shortly to be described. The organ was about normal in size, surface smooth, except for several yellow-white circumscribed masses, round or irregularly oval in form, and varying in size from 2 mm. to the largest masses, 5 mm. in diameter. The smaller growths were on the same plane as the kidney surface, whilst the larger projected above the surface 1 to 3 mm. On section, these new growths were seen to extend for variable distances into the

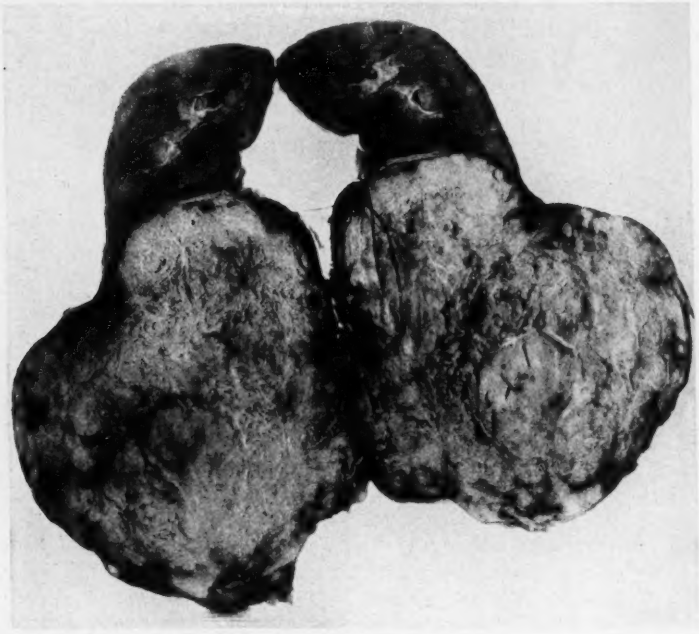

FIG. 1. LEIOMYOMA OF THE KIDNEY

kidney cortex, and maintained their sharp differentiation from the renal structure proper. For the most part these nodules were scattered through the kidney, and all were situated near the external convexity.

In the first case, six of these nodular masses were found, all *subcapsular* in location and averaging in size about two millimetres. *In the second case five were found;* three larger ones (1 cm.) projecting from the surface of the organ, and two smaller ones (2 to 3 mm.) were observed in the deeper portion of the cortex, about 1 to 2 mm. from the surface. None

of the growths in either case appeared in the gross to be connected with the blood vessels. To the naked eye the substance of these masses in the last case seemed to be homogeneous in structure, and the whole mass looked very much like certain metastatic sarcomatous new formations (second case). The masses in the first kidney, however, presented a finely striated appearance and seemed to be encapsulated.

FIG. 2. PYELOGRAM. LEIOMYOMA OF KIDNEY

No distortion of kidney pelvis or calyces by tumor which is attached to the lower pole.

Histological study. Microscopical examination of both kidneys showed the presence of a mild grade of round-cell infiltration and albuminous degeneration in the cortex of the kidney. *Study of the different nodular masses observed in both left kidneys revealed certain features common to all of them. They consisted of bundles of rather loose unstriped*

muscle fibres running in different directions. In the first kidney the fascicular arrangement is more regular and always appears continuous with the capsule. Groups of muscle bundles in this case are further separated by

FIG. 3. KIDNEY PULLED DOWN BY TUMOR MASS, PROVING ATTACHMENT TO KIDNEY

enveloping bands of connective tissue. The muscle tissue arrangement is also in bundles in the second case, but without the separating fibrous strands so conspicuous in the first. The myomatous nodules in the latter are

sharply separated in all instances from the surrounding kidney tissue by narrow fibrous tissue bands; in the other kidney the muscle fibres form a sharp line of tissue against the renal substance which closely hugs the muscle tissue without fibrous tissue encapsulation. Whilst in the first case the new growths are invariably continuous with the capsule of the organ, this is not always so for the masses in the second kidney. Study

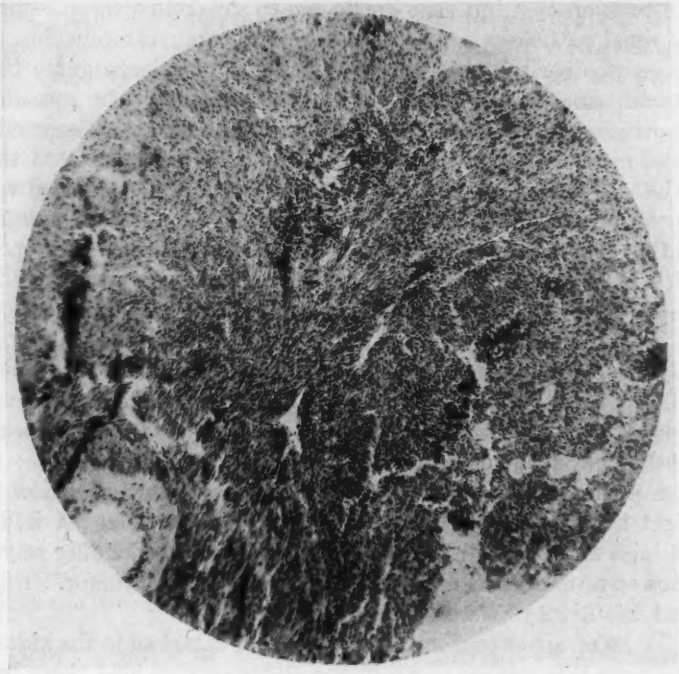

FIG. 4. SECTION OF TUMOR SHOWING ITS COMPOSITION OF SMOOTH MUSCLE

of serial sections of the tissue from the second kidney always revealed an intimate connection with the muscle fibres of at least one medium-sized artery, sometimes two. [This is shown in the picture.]

INTERESTING POINTS IN THE DIAGNOSIS

The findings in my case were as follows: The patient, a female, single, age thirty, a nurse, was first seen April 22, 1927. She

said that she had noticed a lump in the right side of the abdomen since 1915. She thought that it had grown in size but had given no symptoms. Two weeks previously her tonsils had been removed, at which time a physical examination was made and the mass had been noticed and she was urged to seek consultation. She was examined by a gynecologist who thought the mass was an ovarian cyst but sent her to me to determine the possibility of renal pathology. As the patient was comparatively thin, the mass was easily palpated, being the size of a large grape fruit, round, smooth, slightly tender, and movable. The maximum protrusion was at the level of the umbilicus and what seemed to be a normal sized kidney was palpated above the mass. Otherwise the physical examination was negative. The patient's mother had died of pernicious anaemia. I had operated upon her father for a diverticulum of the bladder. One year after operation he developed a tumor in the operative scar which proved to be a carcinoma, and he afterward died of general carcinomatosis.

A cystoscopic examination of this patient showed a normal bladder, the ureters were catheterized, and the urine from each kidney was negative, aside from a slight diminution in the urea output from the right kidney which corresponded with a lowered phthalein output on this side.

A pyelogram showed a bifurcation of the ureter just below the right kidney, there was a division of the right renal pelvis, but the size and outline of each pelvis and the corresponding calyces showed no dilatation or distortion suggesting renal tumor. Right and left kidneys were in normal position.

To ascertain as to whether the mass was attached to the kidney, the mass was pushed down in the abdomen and held there by a metal paper cutter which would show in the roentgenogram. Another pyelogram was made and this film showed that the kidney was pulled down with the mass. A diagnosis of single cyst of the kidney was made, although the firmness of the mass was noted and the possibility of tumor was still considered.

At operation I was able to remove the kidney and tumor mass without difficulty, owing to the freedom of the pedicle. The patient made a rapid recovery. On January 19, 1928 a complete physical and urological examination was negative.

The pathological examination of the specimen by Dr. Frederic E. Sondern is as follows:

Macroscopic examination. The specimen consists of an open kidney, the combined measurements of which are 19.5 cm. in length by 23.5 cm. in width (at its widest part) by 3.5 cm. in thickness. In the lower pole there is a large sharply circumscribed tumor enclosed in a thin fibrous capsule. The tumor measures 13.5 cm. in its longest diameter and appears beneath the renal capsule as a coarsely lobulated reddish tumor with a yellowish mottling. The renal surface is smooth and uniformly red in color. The cut section presents the tumor as a fairly firm structure composed of a smooth white surface with a slight yellowish mottling. In the tumor near the hilus of the organ there are two or three large blood-vessels containing blood coagulum. The renal parenchyma is smooth. The renal pelvis and vessels are not dissected.

Microscopic examination. Sections show smooth muscle tissue, in places composed of fairly long fibers with relatively few nuclei and again in other sections a rather abundant number of nuclei. The cytoplasm is smooth and stains a pale pink with hematoxylin-eosin. The nuclei are fairly large, oval in shape and sharply defined, but not hyperchromatic and show no evidences of neoplastic transformation. Scattered through the tissue are both large and small collections of fat cells. Sections stained with Van Gieson's stain show but very little intercellular connective tissue and sections stained for myelin and by the method of Cajal show no evidences of nerve tissue. Glandular structures are not found in any of the sections made from various parts of the tumor and sections from one of the blood-vessels show no changes. There is no histological evidence of malignant transformation.

Diagnosis. Leiomyoma of kidney.

THE VALUE OF EXPLORATION OF RENAL TUMORS

The *third point* that I wish to make in reporting this case is the *importance of exploring a renal tumor.* If on exploration the tumor is found to be inoperable, one has the satisfaction of knowing this; and on the other hand it is often possible to remove what has seemed to be an inoperable tumor and in an occasional case large renal tumors are proved to be benign, a point that was brought out in a discussion on renal tumors before this Association last year.

PAPILLARY ADENO-CARCINOMA OF THE RENAL PELVIS

GEO. R. LIVERMORE

Memphis, Tennessee

Papillary carcinoma of the renal pelvis is comparatively rare. Young says it is rare and that he had not found a case clearly separated from adeno-carcinoma of the kidney. Meltzer, November 1926, collected 180 cases to which he added the 181st. Hunt, at the last meeting of this Association, May 1927, reported 7 cases, making a total of 188 cases to date. I herewith add the 189th.

White and Ritche state that a correct preoperative diagnosis of kidney pelvic tumors is exceptional. This is largely due doubtless to the few cases reported since pyelography came into general use.

The correct preoperative diagnosis in the case herewith reported was made from the pyelogram, the symptoms and the cystoscopic findings; two days later a second pyelogram was made to eliminate blood clot and when the same filling defect was noted the diagnosis of papillary carcinoma of the left renal pelvis was made.

White and Ritche also state that only a few cases have been recorded in which a complete nephro-ureterectomy has been done for renal pelvic papilloma, but that in their case this procedure was carried out. In the case herewith submitted the left kidney and ureter were removed at the same sitting. There was no evidence of metastases to the ureter in this case but it is the consensus of opinion that the ureter should be removed. I believe the non-existence of extension to the ureter in this instance both macroscopically and microscopically was due to the fact that the patient sought relief within three months from the appearance of the first symptom.

The symptoms, diagnosis, treatment and prognosis have been so fully covered by Smith and Gilbert, Patch and Rhea, Hunt and others, that I shall not burden you with its repetition, except to cite somewhat in detail a case of hypernephroma with a pelvic projection that gave a pyelogram simulating a papillary carcinoma of the kidney pelvis. Deep x-ray therapy was instituted about one month after the operation and a second series given about two and one-half months later. Cystoscopic examination March 16, 1928, about four months after operation revealed no evidence of extension to the bladder and the patient was in apparent perfect health.

Case report, November 18, 1927

M. G. J. White, male, single, age forty-four.

Chief complaint. Hematuria and pain in the left kidney region.

Family history. One paternal uncle died of pulmonary tuberculosis. Mother died of cancer of the liver. One maternal uncle died of cancer of the liver.

Past history. Patient had pulmonary tuberculosis five years ago and was in a sanitarium for several months, then under treatment at home where he has been in bed ever since. His physician pronounced his case arrested two years ago and he has had no fever, no hemoptysis and no dyspnoea since and has gained in weight.

He had the usual diseases of childhood, and had gonorrhoea when sixteen years old.

History of present illness. About three months ago he passed blood stained urine, the first urine was dark but later became bright red. There was a dull aching pain over the left kidney region with occasional sharp shooting pains. He experienced no discomfort on voiding except slight terminal burning. The hematuria disappeared in a few days but the dull ache in the loin persisted. Four weeks ago the urine again became bloody and has continued up to the present time, November 18, 1927.

Physical examination. A rather fat, well-developed male, weight 200 pounds, teeth all have been extracted except four snags. Examination was negative except for lungs and genito-urinary tract. Blood pressure 135/80. Wasserman negative. Blood count, red blood cells 4,500,000. Leucocytes 8500. Hemoglobin 88 per cent. Neither kidney is palpable and there is no tenderness over either loin. Dr. W. T. Swink who

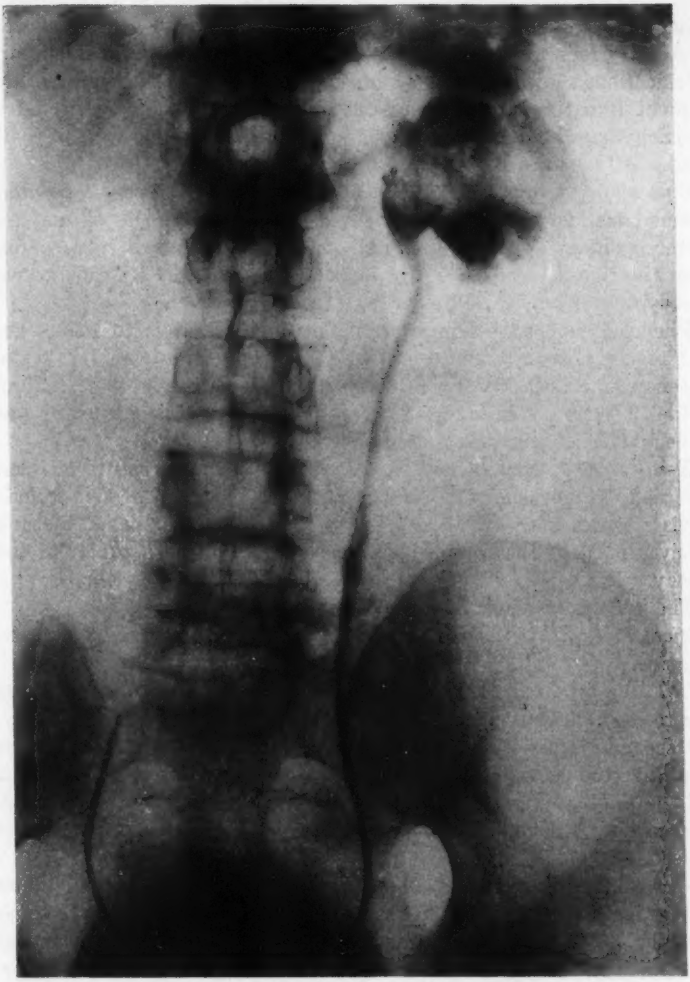

FIG. 1. PYELOGRAM. PAPILLARY ADENO-CARCINOMA OF LEFT RENAL PELVIS. FILLING DEFECT WELL SHOWN

examined his chest reported that he had an arrested case of pulmonary tuberculosis. X-ray of chest and long bones negative for metastases. The X-ray report of his chest was as follows: "Numerous small miliary calcifications showing over both lungs. Considerable thickening of the bronchi radiating upward and outward from the hilus with a few parenchymatous lesions extending well up towards the apex on both sides. All the lung findings appear old and inactive."

Cystoscopy. November 19, 1928. Brown Buerger cystoscope used. Entered bladder easily. The trigone was slightly congested and the ureter openings appeared normal. A bloody efflux was seen coming from the right. A no. 6 X-ray catheter passed easily to each pelvis. Bloody urine from the left, clear from the right.

Phenolsulphonephthalein appeared in three minutes from the right and 14 per cent in fifteen minutes; no dye appeared from the left in fifteen minutes. X-ray and left pyelogram made, injected 11 cc. sodium iodide 12 per cent solution left side, this was drawn off after the film was made and 3 cc. Neosilvol injected.

X-ray report. No evidence of stones in the kidney, ureter or bladder. The right kidney shows no evidence of pathology. The left kidney pelvis shows a marked filling defect which is irregular in outline and involves most of the calyces. This is thought to be a tumor of the kidney pelvis.

The laboratory report of the kidney specimens:

Right kidney. Occasional pus cell. Rare red blood cell. Culture negative.

Left kidney. Red blood cells too numerous to count. 4 to 5 pus cells to the high power field. Culture negative.

A second cystoscopy and pyelogram was done two days later in order to exclude the possibility of the filling defect being due to a blood clot and the findings were identical with those of the first cystoscopy. A diagnosis of papillary carcinoma was then made and left nephrectomy advised.

Operation. November 28, 1927. Left nephrectomy. Usual oblique kidney incision. Perirenal fat very thick and stripped with some difficulty. The ureter was somewhat dilated and thickened near the pelvis. The kidney pedicle was very short, after clamping and cutting the pedicle there was some hemorrhage and an extra clamp had to be applied. As the pedicle was so short and the patient rather fat it was deemed best to leave the clamps on rather than attempt to ligate. Four clamps were left on and gauze packing placed about them. The

ureter was then removed through an incision along the left semilunar line, working outside of the peritoneal cavity, the peritoneum was pushed inward and the ureter exposed, ligated at the bladder and removed. Both incisions closed with cigarette drains to pedicle and

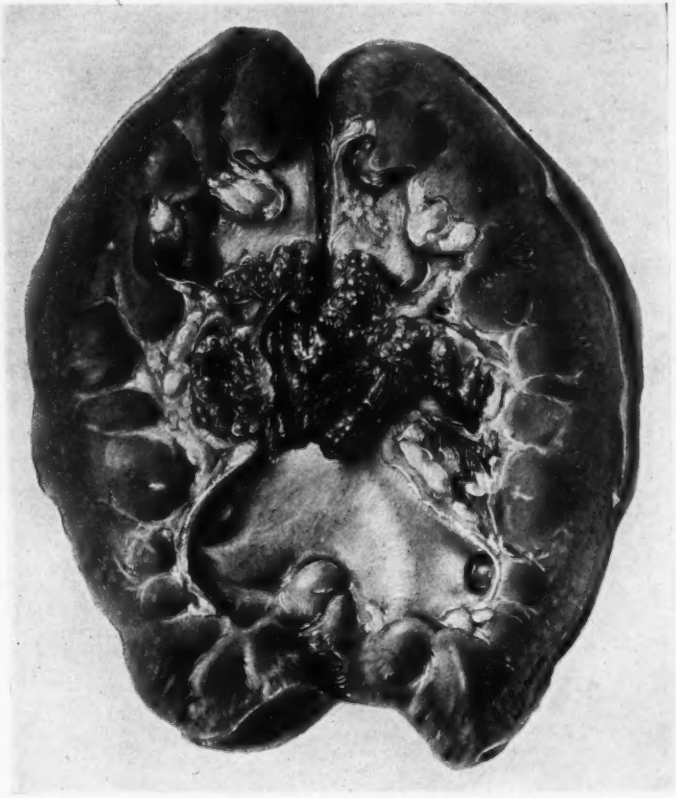

FIG. 2. PAPILLARY ADENO-CARCINOMA OF THE KIDNEY PELVIS

stump of ureter. No. 2 chromic cat gut for muscles and fascia, silk worm gut for skin. The clamps were removed at the end of fifty-eight hours, three were removed without any evidence of bleeding but when the fourth was unclamped hemorrhage was profuse. With sheer good

luck I was able to reapply the clamp and control it. This was left on for forty-eight hours longer and when removed there was no further bleeding. His wounds were healed in three weeks and he made a satisfactory recovery.

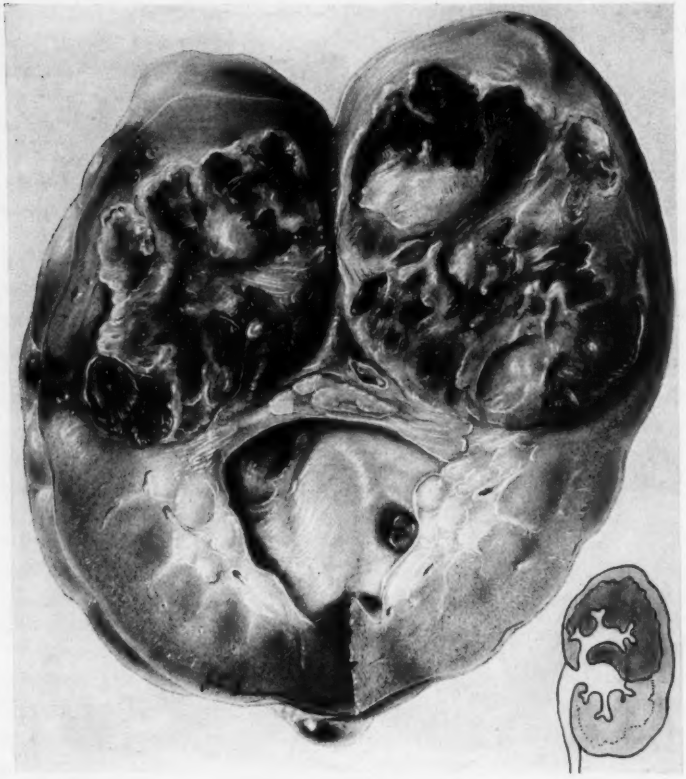

FIG. 3. DRAWING—HYPERNEPHROMA OF THE KIDNEY

Pathological report by Dr. N. E. Leake. The kidney measures 13 by 5.5 by 6 cm. Capsule strips easily. The pelvis is dilated and contains hemorrhagic material and a soft papillary growth. The upper portion of the ureter is dilated and contains blood clot. On bisecting the kidney the calices are found to be moderately dilated, filled with hemorrhagic

material and a soft papillary growth springing from the mucous membrane of the pelvis. The main portion of the growth has a diameter of 5 cm.

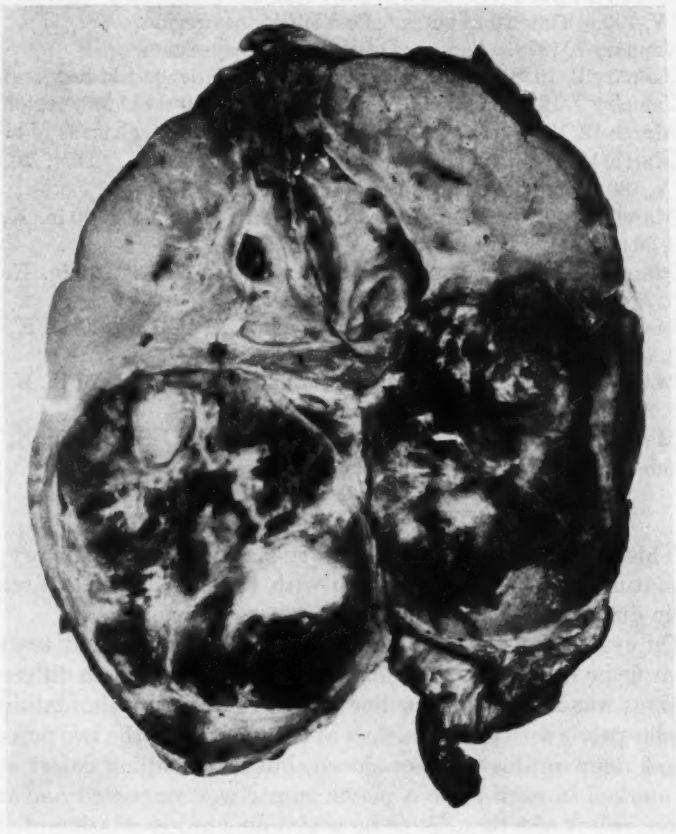

FIG. 4. PHOTO—HYPERNEPHROMA OF THE KIDNEY

Microscopic examination reveals three connective tissue stalks covered with cancerous epithelium. The upper ureter is thickened as the result of chronic inflammation and is apparently free from malignancy.

Diagnosis. Papillary adeno-carcinoma of renal pelvis.

On December 31, 1927, deep X-ray treatments were begun and continued as follows:

December 31, 1927. MA. 4 Filt. cop. 0.5 mm. Al 1 mm. 20 in. K. V. 190. Time 20 minutes. Post left kidney region.

January 1, 1928. Same.—Left lateral kidney region.

January 2, 1928. Same.—30 minutes. Anterior left kidney region.

January 4, 1928. Same.—25 minutes. Left lateral kidney region.

March 12, 1928. Deep X-ray treatments were again given as follows:

March 12, 1928. Four Filt. cop. 0.5 mm. Al 1mm. Dist. 20 in. K. V. 190, 20 minutes. Post left kidney region.

March 13, 1928. Four Filt. cop. 0.5 mm. Al 1C. Dist. 20 in. K. V. 190, 20 minutes. Post pelvic.

March 14, 1928. Four Filt. cop. 0.5 mm. Al 1C Dist. 20 in. K. V. 190, 20 minutes. Left lateral kidney region.

March 15, 1928. Four Filt. cop. 0.5 mm. Al 1C Dist. 20 in. K. V. 190, 20 minutes. Anterior left kidney region.

March 16, 1928. Four Filt. cop. 0.5 mm. Al 1C Dist. 20 in. K. V. 190, 20 minutes. Post left kidney region.

March 17, 1928. Four Filt. cop. 0.5 mm. Al 1C Dist. 20 in. K. V. 20 minutes. Anterior left kidney region.

CASE OF HYPERNEPHROMA OF LEFT KIDNEY

This patient was a man aged fifty-six, who gave a history of hematuria of ten days' duration with two attacks of left renal colic during the same period.

On cystoscopy there was a bloody efflux from the left ureter, clear urine from the right. A pyelogram made at three different sittings was identical in outline and gave a picture simulating a double pelvis with a filling defect at the junction of the two pelves. The kidney outline was not shown, but as the filling defect was so marked in each plate a pelvic tumor was suspected and the upper pelvis was thought to be a hydronephrotic dilation of the upper major calyx, due to obstruction of the tumor. The lantern slides demonstrate the findings nicely.

The comparative rarity of papillary adeno-carcinoma of the kidney pelvis, the fact that the patient had an arrested case of pulmonary tuberculosis, that a correct preoperative diagnosis

was made, that a complete uretero-nephrectomy was done at one sitting and that the patient recovered and was free of any symptom of recurrence 3½ months after operation made this case worthy of report.

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THE APPARENT DISAPPEARANCE OF PULMONARY METASTASIS IN A CASE OF HYPERNEPHROMA FOLLOWING NEPHRECTOMY

HERMON C. BUMPUS, JR.

Section on Urology, Mayo Clinic, Rochester, Minnesota

A patient on whom C. H. Mayo performed left nephrectomy for hypernephroma in December, 1917, presented himself at the Mayo Clinic for observation at irregular intervals for nearly six years. The kidney, with a large hypernephroma in the center, was about three times normal size. A portion of the tumor had extended through the renal vein and projected into the vena cava, which was closed with great difficulty. Until shortly before the patient's death in November, 1923, it was not possible to discover any evidence of metastasis. In fact, his death from "stroke" could as easily be attributed to a vascular lesion as to cerebral metastasis. That there should have been hypernephromatous tissue in the vena cava without subsequent metastasis seemed unlikely. Keyser and Foulds, who studied Mayo Clinic specimens of hypernephroma, said:

> As a rule the hypernephroma enters the venules and grows forward into venous lumina. In the extension it exhibits little tendency to invade or perforate the venous wall which, however, loses its endothelium and becomes thinned in places from the pressure atrophy produced by the growing mass. It is easily understood how minute emboli may break off from time to time and be carried by the venous stream to the lungs. Here the cells are arrested or pass on through the venous stream to the more distant parts.

Therefore, on the patient's subsequent visits to the Clinic roentgenograms of the chest, spine, and pelvis were made repeatedly. Although these were always negative as regards metastasis, I was still not convinced that cells from the growth had not broken

loose and become lodged elsewhere in the body. Rather, it seemed that they might have been rendered inactive by specific antibodies, or destroyed by the phagocytic action of some of the normal constituents of the blood.

In a recent communication from Francis Carter Wood he said:

> In a good many of the hypernephromas the intravascular growths must often undergo spontaneous destruction. It is difficult, for example, to think of anything else; where as I remember a bone metastasis in the tibia occurred which was removed but the primary growth stayed quite a long time. It is scarcely possible to think that there were not other emboli set free in the circulation similar to the one which gave rise to the tumor of the tibia.

The presence of a single metastatic area characteristic of the disease and often long delayed has been pointed out by Berg. Clairmont reported a case in which death occurred from metastasis in the lungs, ten years after removal of the tumor. Broster reported a case in which Sir Thomson-Walker had removed the kidney for hypernephroma in 1914, and the patient was well until 1922, when spontaneous fracture of the femur occurred from metastasis.

Foulds, in a study of the specimens of hypernephroma at the Mayo Clinic found the renal vein or one of the major branches occluded or invaded by tumor in 59 cases. Nine of the number could not be traced, but 8 patients are still living, 1 more than two years, 2 more than three years, and 4 more than ten years. At operation on one of the latter it was noted that the case was unfavorable because of extension along the renal vein.

The longevity in these 8 cases of almost certain metastasis, prompted me to search the literature for data of this nature. I found that Albrecht, in 1905, had reported 2 cases in which the veins were thrombosed with hypernephromatous tissue at the time of operation and the patients were living and well four and a half and twelve years later. Hyman reported 2 cases in which the patients lived three and a half and four and a half years respectively after nephrectomy, although the tumor extended into the renal vein. He said:

Involvement of the renal vein does not necessarily render prognosis fatal, although it diminishes considerably the chance of a cure. . . . . When can a patient who has had a hypernephroma be considered cured? This is not so easily answered for although most of the recurrence takes place within a few days it is characteristic of hypernephroma to metastasize very late.

This same question came to my mind three years ago when a man, aged fifty-nine, on whom nephrectomy had been performed fifteen months previously, presented himself complaining of chronic cough with occasional bloody sputum. He gave a history of three attacks of transitory hemiplegia followed by dragging of the left foot. At the time of nephrectomy the pathologists reported: "Hypernephroma 7 by 6 cm., with destruction of half of the kidney, the tumor filling the pelvis and extending into the pedicle and a metastatic tumor 2.5 cm. in the perirenal fat."

A roentgenogram of the chest (fig. 1) disclosed multiple metastatic areas in both lungs. As the outlook was so discouraging and the patient anxious to return home a neurological examination was not made, and it was assumed that the attacks of hemiplegia were due to cerebral metastasis similar to that in the lungs. With temerity I presented an optimistic attitude and explained to the patient that as so little could be done to mend matters he had best try to forget his condition and go home and carry on. This he did so well that five months later (September, 1925) while touring he called to report that he had gained in weight, was doing full work, and considered himself in perfect health. At my request he stayed long enough to have roentgenograms made of his chest (fig. 2); as may be seen all evidence of the former metastatic nodules had disappeared. In April, 1928, more than four years after the removal of the primary growth, the lungs were still clear and there were no other signs of metastasis (fig. 3). At a recent examination more than five years after the operation he appeared in excellent health, and visited the Clinic while on a trip through the Northwest.

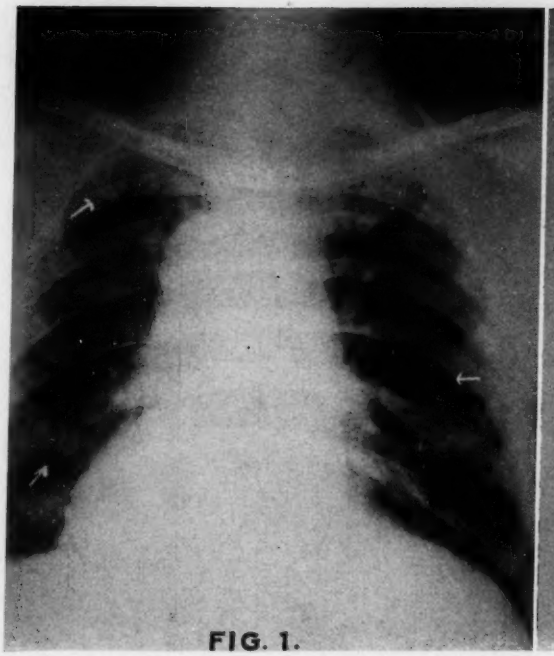

FIG. 1. APPARENT METASTASIS IN LUNGS

Nephrectomy had been performed for hypernephroma fourteen months previously.

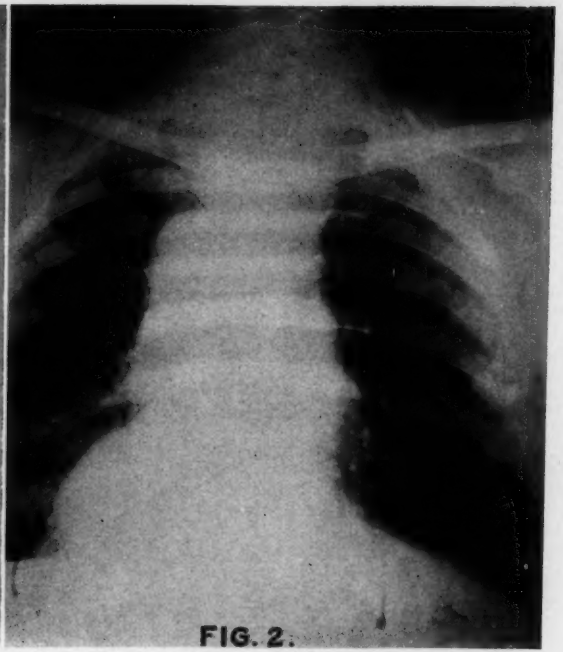

FIG. 2. FIVE MONTHS AFTER FIGURE 1

All evidence of metastasis has disappeared

Rohdenburg stated:

It can be definitely asserted that regressive changes varying from a temporary standstill to complete disappearance of the tumor whether it is of epithelial or connective-tissue origin may occur at any age period

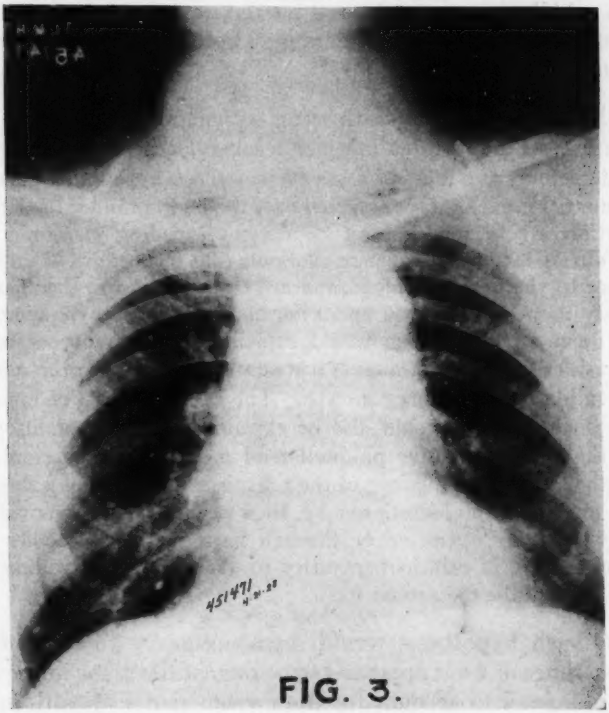

FIG. 3. THE CHEST TWENTY-SIX MONTHS AFTER OPERATION
No evidence of metastasis

in either sex and irrespective of the location of the growth. Necrosis followed by calcification is the type most frequently associated with spontaneous absorption.

The Mayo Clinic case is evidently not of this type but more closely resembles the metastasis of chorio-epithelioma which has

been reported to regress after the removal of the original growth. Ewing in a conservative discussion of the subject said: "Some of these cases point to a possibility that an isolated metastasis in the milder forms of chorioma may regress after the removal of the main tumor." He refers to 8 cases which he considers authentic in which recovery followed partial removal of the tumor, metastasis or extensions remaining. Peterson says with regard to chorio-epithelioma:

> In the majority of cases death occurs within six months . . . . nevertheless, cases are reported in which recovery occurred after curetting or hysterectomy and in a few cases even after the appearance of metastasis in other organs. It is assumed that the body produced antibodies (syncytiolysin) to render inert or destroy invading chorionic cells. When during labor or pregnancy chorionic cells or portions of villi gain entrance to the maternal blood and are transported to other parts of the body they are destroyed under normal conditions by the syncytiolysin. Such an assumption would explain the occurrence of benign metastasis or the disappearance of metastatic growths after the removal by operation of the primary growth. The cases reported of apparent spontaneous recovery would also be explained. Under conditions in which there is an excessive production of metastasis of chorionic elements the syncytiolytic power of the organism may become exhausted and a malignant proliferation may then occur. After removal of a primary focus by operation or through necrosis the antibodies may again be formed in sufficient quantity to overcome the invading cells and to destroy the metastatic foci.

Some such hypothesis would seem necessary to explain the disappearance of what appeared to be metastatic areas in the lung in my case, and to account for the present perfect health in the 8 cases in which hypernephromatous tissue had extended into the renal veins. In reporting the foregoing case I am supported by various roentgenologists who examined the films, including the late Dr. Carman, who agreed that no other interpretation is possible.

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REPORT OF A CASE OF CO-EXISTENT RENAL TUBERCULOSIS AND RENAL CALCULUS

R. F. O'NEIL

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The occurrence of true renal calculus associated with renal tuberculosis as opposed to the calcification and phosphatic deposits so often seen in tuberculous kidneys is an uncommon condition. The areas of calcification so commonly observed in the radiographs of tuberculous kidneys are easy of recognition by their diffuse distribution and irregular and mottled appearance. Localized deposits and tuberculous glands may, however, at times closely simulate true calculi and are only to be diagnosed by operation, even the pyelogram and ureter catheter being at times misleading.

In 1920 Fowler reported a case of the co-existence of true renal calculus and renal tuberculosis, and in the discussion that followed, other cases were mentioned by Caulk, Kretschmer, Gardner and Braasch. In 1923 I reported a case of the simultaneous occurrence of tuberculosis, calculus and papilloma in the same kidney, and in 1924 Schupe reported a case of double kidney with tuberculosis and calculi. All of these were read before this society. I wish to put on record another case which occurred in my present service at the Massachusetts General Hospital.

In Cabot's "Modern Urology," first published in 1918, in the chapter on renal tuberculosis, under predisposing causes, I wrote the following:

> Further evidence that trauma is not an essentially causative factor in renal tuberculosis is presented by the literature of renal calculus. While undoubted instances of simultaneous occurrence of renal calculus and renal tuberculosis, and the development of renal tuberculosis in a kidney previously the site of calculus, are found in literature, these conditions are rare. In 256 cases of renal calculus and renal tuberculosis reported from the records of the Massachusetts General Hospital,

no cases of true calculi were found in tuberculous kidneys as opposed to the calcareous deposits, nor were there any cases of the development of tuberculosis in kidneys from which calculi had been removed. There can be no doubt that the trauma produced by a calculus is quite sufficient to invite tuberculous infection, were trauma any considerable factor in the etiology.

From the foregoing reported cases it would appear that the condition is not as rare as the figures from the Massachusetts General Hospital would indicate.

The case report is as follows (it is interesting to note that the early symptoms as in Fowler's case, were those of calculus rather than tuberculosis):

F. N., a woman of forty, married, entered the Urological Service of the Massachusetts General Hospital on February 16, 1928.

Previous history. About one and one-half years ago, sudden, severe, sharp pain in the lower abdomen and right flank which radiated to the vulva. Pain caused her to "double up" but was controlled by morphia. The attack lasted for two or three days. She passed no stone. Six months later she began to have increased frequency of micturition which has been becoming more marked up to the present time and has become associated with burning and nocturia. Six months ago on one occasion she passed a small amount of blood in the urine. The examination shows a rather thin, undernourished woman; chest and extremities are negative; in the abdomen, filling the upper portion of the right flank and the right upper quadrant, is a mass the size of a grapefruit, firm, non-tender, is probably lobulated but not nodular. Mass moves with respiration and is undoubtedly connected with the kidney. The left kidney is not felt. Vaginal examination is negative. Urine by catheter, cloudy, acid, specific gravity 1020, sediment loaded with pus cells. The urine was searched for tubercle bacilli but none were found. Leucocyte count 12,400. There is a slight temperature of 99.5. Renal function, appearance time six minutes, 50 per cent of the dye excreted in the first hour, 10 per cent in the second. After two weeks of drainage with catheter, renal function, appearance time four minutes, 60 per cent excreted in first hour, 15 per cent in the second. On three occasions the non-protein nitrogen estimation was 32, 26, and 33. She was cystoscoped several times and attempts were made to catheterize the ureters. Although the bladder appearance improved under constant drainage

FIG. 1. SHOWING SHADOW OF CALCULUS IN TUBERCULOUS RIGHT KIDNEY

there was so much edema and cystitis present that neither ureter could be definitely located. The appearance was that of tuberculosis.

The x-ray showed the outline of the kidney on the right to be much increased in size, and denser than usual. Within its area was a dense, irregular shadow. The left kidney outline was faint but apparently normal (fig. 1).

As the patient had an excellent renal function and a normal blood nitrogen and was running a slight temperature, operation on the right kidney was advised in spite of the fact that we had been unable to catheterize the left. On March 8, under ethylene anesthesia, right lumbar nephrectomy was performed. Kidney was found very much enlarged, and was removed with considerable difficulty. After operation the appearance of the urine was much improved. She was kept on constant drainage. Unfortunately she developed broncho pneumonia and died on the tenth day.

Pathological report. Kidney 15.5 cm. long, has a stump of thickened ureter attached. The capsule is thick and deep red. On section the pelvis and calices are dilated and filled with thin pus. They are lined by thick, grayish white membrane. In one portion of the wall of this is an irregular, dark calculus the size of an olive. Renal substance forms a thin rim about the periphery. Microscopic examination shows large focal collections of epithelioid cells with many giant cells and large areas of caseation. Pathological diagnosis: tuberculosis, nephrolithiasis.

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DISCUSSION

Dr. ARTHUR H. CROSBIE (Boston): I was very much interested in Dr. Bumpus' paper as it perhaps explains a case that has always puzzled me. In 1919 I operated on a woman for a very large tumor of the left kidney. I did a transperitoneal nephrectomy and in cutting through the pedicle I was aware that I was cutting through new growth. I took out as much of it as I could but I know I left some of it in. The pathological report was hypernephroma and the malignant cells extended to the cut edge of the pedicle.

I gave a very bad prognosis and expected her to have recurrences early. I saw the woman the other day and she is in perfect health. She has never had any sign of recurrence. I am perfectly sure there were malignant cells left in that pedicle.

Dr. BENJAMIN S. BARRINGER (New York): I think Dr. Livermore's paper brings up the interesting question of the etiology of these cases of papillomatosis or papillary carcinomatosis of the kidney, ureter and bladder. Whenever those cases have come up to us at the Memorial, Dr. Ewing has always suggested we look for the cause of the tumor, suggesting that rather than implants from the kidney to the ureter and bladder it might be that the same factor which caused the kidney tumor, irritation from analine dye excretion, etc., might and probably was present in both the ureter and bladder as well as the opposite kidney and ureter. If so, we ought to find papillary carcinomatosis of the opposite kidney or ureter. I am interested to know if anybody has seen such a case. It would be rather interesting from the etiological standpoint. I think the moral of Dr. Livermore's paper is to leave the clamp on until it sloughs off.

Dr. Bumpus has brought up a very interesting question about the secondaries in the lungs and I think that there is one point we ought to emphasize, that we should not wait for lung metastasis to

spontaneously evaporate. The lung metastasis should be radiated. I am wondering if he radiates lungs in all cases in which he finds secondaries. We have had several interesting cases of a similar kind of tumor, that is teratoma of the testis, where we may get large metastasis in the lungs. The other day I saw a case who originally had teratoma of the testis and metastasis in the abdomen and lungs. That was three years ago. He still has the testicle shrunken and fibrotic but he has no symptom of disease as far as we can tell, in either abdomen or lungs. He was extensively and severely radiated.

I think in hypernephroma, a good many cases might act in the same way and be radiosensitive. It seems to me, whether radiosensitive or not, that the lungs should be radiated.

Dr. GEORGE R. LIVERMORE (Memphis): I would like to report a case similar to Dr. Crosbie's. This patient, whom I saw two and one-half years ago, had hypernephroma of the kidney. Dr. Caulk was in Memphis and he saw the patient in consultation with the physician in charge and myself. Metastasis was definitely seen in the lung, so both Dr. Caulk and I advised against removal of the kidney and the physician in charge concurred. The patient had a secondary colon and staphylococcus infection and continued having fever and sweats with very marked irritability of the bladder. Finally the doctor consulted me and said the patient was so miserable, what about taking the kidney out; that the patient would be down in bed about every ten days or two weeks and it would take about that long to get over each attack. I advised him to operate and remove the kidney. He took the kidney out and the patient is well, back at work and perfectly comfortable and he seems apparently cured and in good health.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): The paper that Dr. O'Neil gave was one of unusual interest. He called attention to a common error in diagnosis, namely, the confusion of stone with renal tuberculosis because of the similarity in roentgenographic shadows.

One of our Fellows, Dr. Omohundro, recently reviewed the records of the Mayo Clinic in regard to the coincidence of stone and renal tuberculosis, and found that in 1079 cases of renal tuberculosis there were 19 or 1.75 per cent cases of coincident stone. During this period there were 2545 patients operated for stone and in 0.75 per cent there was coincident renal tuberculosis. It is evident that this coincidence occurs more frequently than we had previously supposed. In 2 of the 19 cases the diagnosis of tuberculosis was not made at operation. One patient was operated on for stone in the ureter and the other for stone in the kidney, and in subsequent operations the kidneys were removed in both cases for tuberculosis. In the last case renal tuberculosis was apparently present in a circumscribed form at the time of the first operation and was overlooked. Pieces of calcified material are frequently found in abscessed areas of renal tuberculosis which are not true stones, and were not included in the 19 cases referred to.

Dr. HERMAN L. KRETSCHMER (Chicago): The occurrence of papillomata in the bladder, in the vicinity of one or the other ureteral orifice, is always an interesting diagnostic problem. Because of their location, it immediately raises the question of whether they are primarily in the bladder, or whether they are secondary to papillomata of the kidney pelvis and the ureter.

Several interesting papers upon this subject have appeared by several of our members. Dr. Lower and Dr. Culver have both reported very interesting papers on this subject.

Our procedure has been to make a pyelogram, as a routine, after the tumors around the ureteral orifice have been removed by means of fulguration. At the present time I have 3 patients under observation who have recurring papillomatosis around one ureteral orifice. The pyelograms are negative in all 3 cases. I think one is perfectly justified in doing a nephrourecterectomy in every case of papillomatosis of the kidney pelvis even if the ureter is normal at the time it is removed.

Dr. O'Neil's paper is very instructive, illustrating the fact that so many times a patient may have more than one type of renal

pathology and we must always be on the lookout for such a possibility.

Dr. Bugbee, I feel, should be congratulated upon his very interesting and very rare type of kidney tumor. I feel sure that the reporting of these rare types of kidney tumors is going to give us a different notion regarding the incidence of some of these so-called rare kidney tumors and maybe they are not as rare as we are inclined to believe. Most of the cases of this type are autopsy reports so far, if I remember correctly.

Dr. RICHARD F. O'NEIL (Boston): I was particularly interested in hearing Dr. Bumpus and some of the others emphasize the fact that extension of hypernephroma into the renal vein is not necessarily immediately fatal. I can recall some years ago helping Dr. C. A. Porter of Boston operate on a man for a large hypernephroma which extended into the renal vein, in fact the ligature went through a portion of the tumor. That man lived for three years and finally died of cerebral and pulmonary metastasis.

He also had a curious tumor in one of the tendon sheaths of his wrist which on removal was found to be a hypernephroma.

Dr. WILLIAM C. QUINBY (Boston): The outlook in malignancy is so dismal that I think such a report as that of Dr. Bumpus is very important to have on record. The remarks which I wish to make concern an analogous case, occurring in the knowledge of Dr. Wolbach, the Professor of Pathology at the Harvard Medical School. It has to do with a boy some twenty-three or twenty-four years old who had a large tumor of the retroperitoneum, which was operated on and specimens of the tissue sent to Dr. Wolbach for diagnosis. The tumor was not removable so that only a biopsy was made by the surgeon. Dr. Wolbach found it to contain cells characteristic of embryoma of the testicle, and inasmuch as the surgeon was not able to remove it, he advised that the mass be radiated. This was done, and on physical examination today it is impossible to find any evidence of the tumor. It has entirely disappeared, and incidentally the patient still has his testis which shows an irregular nodule in one pole or the other, I

don't remember which. Apparently here again is an illustration of the fact that during considerable periods of time, tumors of known malignancy may be held in abeyance, as far as their continuation of growth is concerned, by deep x-ray therapy. In the occasional case, therefore, one may offer a somewhat less gloomy prognosis than is usual.

Dr. HERMON C. BUMPUS (Closing): I have nothing to add except in answer to the question of radiation. It has been our feeling that when metastasis were present the case was beyond hope of benefit from any form of treatment.

THE CONFUSION BETWEEN THE PAIN OF SPLENITIS AND THAT OF A RENAL LESION

ARTHUR L. CHUTE

Boston, Massachusetts

My very brief communication has to do with two instances in which pain of some duration in the left loin, and supposed to be of renal origin, seemed to be accounted for by a splenitis. The condition was new to me and is reported as a possible explanation of occasional instances of obscure, left-sided pain, supposedly renal, but in which no evidence of renal change can be found.

The first case was of a woman of forty-two, seen in 1925. Her only pregnancy had been normal and she had been well up to about four years before, when she began to have "spells in which her left side seemed to swell up." These attacks, which at first had come two or three times a year and lasted perhaps for a week, had been getting more frequent. She reported that three years before she had been radiographed and told though the x-ray showed nothing, that she probably had some trouble with her left kidney and that she should have an exploratory operation, that there was also "a little trouble with her spleen." Four months previous to the time I saw her, she had had an attack of unusual severity for which she had been in a hospital for about ten days. She had been having an increased amount of pain for the two weeks just previous to the time she came.

Her story suggested to me the probability of a hydronephrosis. Examination showed a urine that was transparent and contained nothing abnormal. She had a slight tenderness in her left loin; her bladder showed no changes. Plain x-rays showed a spleen that was large and contained a number of calcified areas. Pyelography showed a left kidney pelvis that held between 4 and 6 cc. of pyelographic medium and was within the limits of normal. Nothing was advised other than general hygiene. On April 12

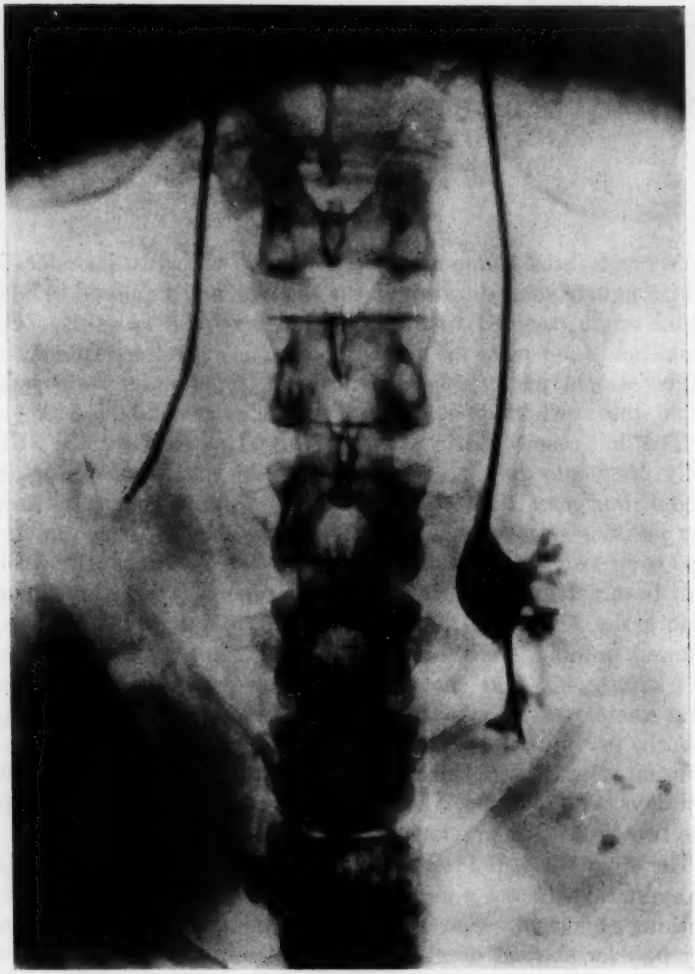

FIG. 1. The calcifications to the outside and above the left kidney represent calcified areas in the woman's spleen. Unfortunately, the outlines of the kidney and spleen are not as good as one might wish.

of this year, this woman's physician reported that she no longer had her pain and was feeling quite well.

It seemed to me at the time that the evidence in this case was suggestive perhaps rather than conclusive, that this patient's pain was due to her splenitis or peri-splenitis. The second case that came under my observation seemed to heighten the probability that this woman's pain was due to the changes in her spleen.

A very frail man of eighty-four, practically bedridden, who had been catheterized for four years, was seen in December, 1925, because of the difficulty and pain that he was having each time his catheter was passed. A soft rubber catheter was passed easily, with the help of a stylet, and this patient was kept upon constant drainage from that time until the time of his death just a year later. He was so very frail and so comfortable except when his catheter was changed, that operation did not seem best. For some years this patient had complained from time to time of persistent pain in his left side, which it had been assumed was probably due to a left pyelonephritis.

At autopsy it was found that this patient's right kidney had been well destroyed; that while his left ureter was somewhat dilated, the kidney itself showed surprisingly little evidence of disease. His spleen was increased in size and was covered with very many calcified areas which seemed to the physician under whose care he had been and to the pathologist who did the autopsy to account very well for the man's left sided pain, for which no entirely satisfactory explanation had been found.

These cases of pain due to splenitis are reported, as I have said in the beginning of my paper, as a possible explanation for certain cases of left sided pain of obscure origin. In the two cases that have come under my observation the areas of calcification were marked and it was this that called my attention to the condition. I do not know whether this deposition of lime salts is always a late manifestation in this inflammatory condition of the spleen, as seems to be the case in the calcified mesenteric and retroperitoneal glands, or whether it may take place early. If it is a late manifestation, as I should suppose, it would rarely be of much diagnostic help. In the first case it was, however, present at the

time that the patient had her pain. We have no evidence as to whether calcification was present at the time the second patient had his pain, though it was found later.

It seems probable to me that these calcified areas represent quiescent areas, and that the pain is very likely due to other areas in which the focus is still acute and in which calcification has not taken place; that these areas of calfication, the sign which allows us to recognize the condition, are evidence of previous inflammation and presumptive evidence that the pain from which the patient is suffering at the time is due to other, as yet uncalcified, areas.

SOME STUDIES IN THE DISTRIBUTION OF BLOOD-BORNE FOREIGN PARTICLES, INCLUDING BACTERIA, IN THE KIDNEY[1]

DAVID W. MacKENZIE AND ALLAN B. HAWTHORNE

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For some years past the department has been studying the question of renal infections, from several viewpoints. Beginning with the question of bacteriology of ureteral cultures, published some four years ago, and later the investigation of the question, of the relation of stasis to the pyelonephritis of pregnancy.

Carrying out the investigation from a different angle, and especially because of the difficulty in watching the course and distribution of bacteria in the kidney, we have used the method of watching the distribution of foreign particles, as such are easily seen both grossly and microscopically. It was hoped that from this study some analogy could be drawn between the behaviour of particles such as ink, and bacteria.

The particle used was a colloidal solution of carbon or india ink put up under the name of "Pelican Ink." This solution was diluted with 0.9 per cent saline and filtered through hard filter paper before the injection was made. For injections into the general circulation rabbits were used, and for the injections into the renal artery, dogs were used in order that a larger vessel would aid in the experiment.

Now india ink particles have been injected into the general circulation by many investigators including Nagao (3), Tait and McCartney (4), Foot (5), Brickner (6) and others. They were mainly interested in its deposition, in the reticulo-endothelial system. Several of these noted that ink was found in the capillaries of the glomeruli, but in very scanty amount as compared with that found in the liver, spleen and bone-marrow.

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Tait and McCartney (4) have shown, that following the injection of ink intravenously, that capillary thrombi are found in the glomeruli and in the afferent vessels to the glomeruli; occlusion of the glomeruli brings about in a few hours all the microscopic changes of acute nephritis.

Brickner (6) has shown that with a sufficient dosage of ink, intravenously, that the endothelial cells of the capillaries pick up ink particles. He claims that it is shown, that where the capillaries are most numerous or most tortuous, the carbon appears in

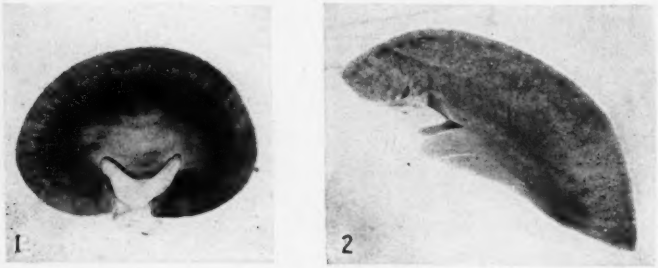

FIG. 1. Cross section of rabbit's kidney twelve hours after injection of 20 cc., 1:4 ink, intravenously. Glomeruli stand out prominently, dotted in black throughout the cortex, especially near the surface of the kidney. The papilla and pelvis are free from ink. Darkening in cortico-medullary region due to congestion and not to ink.

FIG. 2. Section of kidney in figure 1 showing black dots of glomeruli, especially marked in ring just under the capsule.

greatest quantity. Among the organs not grouped with the reticulo-endothelial system, it is demonstrated that, the largest number of particles are taken into endothelial cells, where opportunity is greatest for contact between the endothelium and the particles. Improvements in such opportunity are believed to depend upon the number of endothelial cells per unit of tissue, upon the tortuosity of the capillaries, and upon the dosage of carbon received by the tissue.

Now we have found in our experiments on 95 animals that following the intravenous injection of ink, of a small dose that very

little ink is seen in the kidney—and practically no information as to distribution can be obtained. Beyond an occasional particle found in a glomerular capillary, or an intertubular capillary, there were no pathological changes. If the dose is increased such as 20 cc. of a 1:4 dilution of ink in a rabbit of 2000 grams, then we noted that much more ink was deposited in the kidney.

Rabbits of the same weight were given the same dose intravenously and killed at varying periods. Examining the kidneys grossly, we noted that both right and left kidneys were equally affected.

For the first hour or two—and while the ink was still in the general circulation, either as particles or in phagocytic cells, that the whole kidney surface was a purplish black, and that the capsule was tense. On section the cortex and medulla were equally a greyish black, superimposed on the red brown or natural kidney colour. If several more hours elapsed, the medulla was cleared of its black colour, the cortex remaining about the same colour.

In eight hours the medulla would be completely cleared, with perhaps a few inflammatory streaks leading down from the cortex to the papilla. The cortex at this time would show innumerable fine black dots scattered throughout. The great majority of these would be marked out in a fine black, almost continuous line, around the kidney cortex just under the capsule. Evidently the outermost ring of glomeruli.

From this time on the amount of blackening would gradually decrease, and at the same time there would arise a certain amount of inflammatory reaction, which would gradually subside.

Seen in microscopic section at first the ink is entirely inside the capillary, either as coagulated particles or in the phagocytic cells. The major portion of the ink was caught up in the fine capillaries just under the cortex and in the capillaries of the glomerular tuft, and to a lesser extent in the intertubular capillaries of the medulla. The ink in these situations would gradually become picked up by phagocytic cells and removed to rèticulo-endothelial-tissue.

Where an embolus formed of coagulated particles or phagocytic cells, then blocking of the arterial system occurred. This in the case of glomeruli led to anaemia of the tubules supplied by that

artery and disentegration followed, a typical degenerative and exudative inflammation.

The changes in a plugged glomerulus depended in a large extent as to whether the circulation through the glomerulus was blocked wholly or in part. If plugged entirely it appeared unchanged

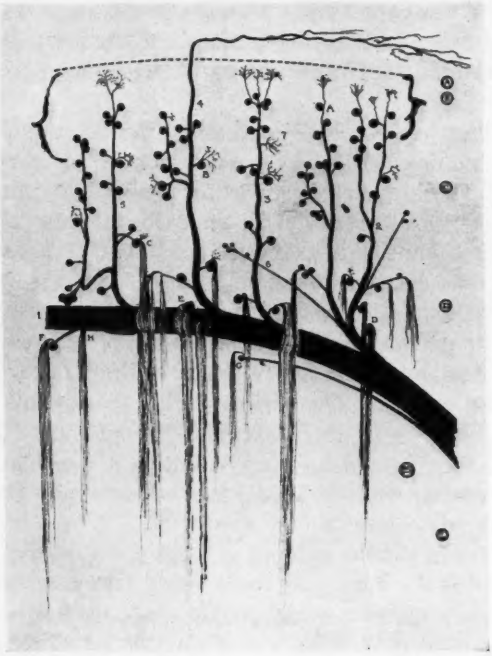

FIG. 3. Diagram from Hinman and Morrison showing terminal glomeruli and their efferent arteries, most frequently plugged with ink. (Area in brackets.)

except that all the capillaries of the tuft were filled with agglutinated ink particles. If blocked only in part, then there was congestion of the remaining loops with red blood cells, phagocytic cells, an outpouring of albumin into the intracapsular space and the formation of albuminous casts in the convoluted tubules.

Ink particles were occasionally seen in the intracapsular space

where a rupture of the glomerulus took place. The greater portion of the ink in the glomeruli would in time be carried off by phagocytic cells, and the acute inflammatory changes resulting from the blocking, subside without any permanent damage. If the blocking is permanent then disentegration of the tubule supplied by that efferent glomerular artery occurs, and is replaced by fibrous tissue, and a typical infarct is produced.

Injection of ink particles thus will produce acute inflammatory changes in the glomeruli, from which the kidney is able to recover, without producing a typical chronic nephritis. If the plugging of the glomerulus is permanent, then an infarct results, though no signs of a chronic nephritis were found. Now in the cases where the dosage of ink given was sufficiently large, from 6 to 8 hours after injection, when the greater portion of the ink inside the capillaries had been carried through the kidney, it was noted that fine granules of ink were deposited in the endothelial cells of the capillaries, both in the glomerular tufts and in the intertubular capillaries. Of the particles of ink some were definitely inside the endothelial cells—while others were simply adherent to the surface of the cell. These particles in the endothelial cells do not seem to bring about any changes in the glomerulus, as particles were seen in the endothelial cells of glomeruli three months after the original injection, and without producing any evidence of chronic nephritis, such as proliferation of cells of the tuft or the formation of crescents. The ultimate fate of these particles or these cells containing these particles we do not know.

Brickner (6) has also found particles of ink in the endothelial cells of the capillaries following the injection of ink.

Pappenheimer (7) found streptococci in the endothelial cells of the glomerular tuft, following injection into the general circulation.

It was also noted that certain fixed cells in the submucosa of the pelvis and calyx, had the property of picking up fine granules of ink if the dosage was sufficiently large. Wandering phagocytic cells containing ink particles were also found in the submucosa.

With this in mind, and also realizing that duration of contact increased the opportunity of these cells to pick up particles, a series of experiments was carried out, in order to increase the congestion

about the pelvis and also to slow the circulation through the kidney. Hinman and Morrison (8) have shown that this occurs in hydronephrosis. We also wished to watch the deposition of these particles under conditions of increased pressure in the pelvis, such as would commonly occur in pyelonephritis, and infected hydronephrosis. The technique of the experiment was to ligate the left ureter of a rabbit, and three days were given to allow a definite hydronephrosis to develop. Then the ink was given intravenously and the animal killed in twenty-four hours. Here then we were able to study the distribution and deposition of ink both in the normal right kidney, and in the left kidney, which had been subjected to increased intrapelvic pressure.

In the right kidney the distribution of ink was as previously described. There was no darkening with ink about the pelvis or peri-pelvic tissues.

The distribution in the left kidney was somewhat different. The greater darkening with ink was in the tip of the papilla, and in the submucous tissue surrounding the pelvis. When a small injection of ink was given the greater darkening would be in the tip of the papilla and about the pelvis, with fine dots of black in the glomeruli of the cortex.

Increasing the dose, increased its deposition in the glomeruli and its efferent arteries. Grossly the cortex was definitely black, while the medulla was pale except about the papilla. The submucosa of the pelvis, calyx and about the uretero-pelvic junction was markedly blackened.

The urine from the hydronephrotic sac contained, casts, red blood cells and epithelial cells. Several of these hyaline casts and epithelial cells contained particles of ink.

When seen microscopically the ink in the right kidney was distributed as previously described, mainly in the glomeruli and intertubular capillaries and with only an occasional particle in the submucosa of the pelvis. Whereas in the left kidney where back pressure in the renal pelvic had occurred, there were large deposits of ink in the intertubular capillaries of the medulla. This ink was partly free in the capillaries as emboli, partly taken up by endothelial cells of the capillaries, and in some places, adherent to

these endothelial cells. Part of the ink in the capillaries was also in phagocytic cells in the blood stream. Now about the pelvis and calyx and uretero-pelvic junction, there were large deposits of ink, as agglutinated particles and emboli in the capillaries immediately beneath the pelvic mucosa; part of this was free ink and the remainder in phagocytic cells. Some of the finer granules were within and also adherent to the endothelial cells of the capillaries.

Immediately beneath this area in the loose fatty and areolar tissue were deposits of ink and ink laden cells. Some of these cells were wandering histiocytes and others fixed fibrocytes. This was occasionally noted in the free or right kidney but the amount was definitely increased on the side of the hydronephrosis.

Now Aschoff (9) has shown that endothelial cells of blood capillaries pick up foreign particles after repeated injection, or when suitable large doses of ink are injected. The fibrocytes or fixed connective tissue cells store the granules in a variable degree after prolonged staining, and in the form of fine granules. These fibrocytes are present in the connective and areolar tissue in the submucosa of the pelvis.

According to Aschoff (9), these fibrocytes only exert this function of picking up foreign particles when there is a marked abundance of granules and when the reticulo-endothelial cells are already more or less filled.

Now under the conditions of increased intra-pelvic pressure it seems that even small doses of ink are picked up by these cells, they being evidently altered in some way by the increased congestion. Part of the deposition of ink is evidently entirely due to the slowing of the circulation, and the formation of emboli in the finer capillaries under the mucosa of the pelvis.

Now in certain situations, in the pelvic mucosa, especially at the tip of the calyx, and at the junction of the calyx and pelvis proper, there were seen fine granules of ink in the epithelial cells of the pelvic mucosa. Part of this ink was intracellular and part evidently between the cells. It was not in wandering cells making their way between the epithelial cells. Also in the cells cast off

into the hydronephrotic sac and examined after centrifugation, there were noted fine granules of ink in several of these cells.

When we turn to the injection of bacteria, we can not as yet, add much information. Bacteria, killed by autoclaving, and diluted in saline were injected intravenously both with and without ligation of a ureter. The cultures used were Staphylococcus aureus and B. coli communis. Beyond finding these in the Kupfer cells of the liver and in a few wandering phagocytes in the glomeruli of the kidney, no information was obtained. We were unable to find any bacteria in or about the pelvis following ligation of the ureter.

Helmholz and Beeler (10) and also Lepper (11) have shown that bacteria tend to localize in the papilla, though their injections were made with live cultures. David and Mattill (12) also found in their work on injections of live bacteria in the kidney that there was a marked polymorphonuclear exudate in the submucosa of the pelvis.

The distribution of living bacteria in the kidney, as seen following injection into the general circulation, will be the subject of a subsequent study.

SUMMARY

Colloidal particles of ink injected into the general circulation, in small doses, pass through the kidney circulation without causing any damage or being picked up by any cells.

In larger doses there is a temporary blocking in the finer capillaries of the glomeruli and of the intertubular capillaries in both cortex and medulla. This blocking by ink emboli causes a typical acute glomerulitis, with accumulation of red blood cells, leucocytes and outpouring of albumen and degeneration of the tubule cells. The ink in most cases is carried off by phagocytes to the reticulo-endothelial system and the blocking relieved; the glomeruli and convoluted tubules return to normal.

When the emboli remain permanently lodged in glomeruli then an infarct results, later replaced by scar tissue. The ink seems to lodge most easily in the outermost glomeruli. That is in the terminal glomeruli of the interlobular arteries, a situation similar to that seen in cortical abscess of the kidney.

Where a large dose of ink is given, this temporary blocking brings about changes in the urine, that is, the presence of albumin, casts and red blood cells. This passes off in from three to four days.

In cases where the dosage is suitable, fine granules of ink are taken up by the endothelial cells of the capillaries in the glomeruli as well as the intertubular arteries. This apparently is permanent but brings about no change in the individual cell.

Wandering and fixed tissue cells in the submucosa of the pelvis also pick up ink particles, and where the ureter is ligated before the ink injection is made, then an increased amount of ink is picked up by these cells.

The endothelial cells of the capillaries of the pelvic mucosa under these conditions also pick up increased amounts of ink. Ink is also picked up by the pelvic epithelial cells. Those most commonly affected lying at the junction of the pelvis proper and the calyx. These epithelial cells containing ink particles were found in the centrifuged contents of the pelvis, along with hyaline casts containing ink.

Ink is not excreted by the kidney normally, but may appear in the urine, when there is some damage to the glomeruli.

Emulsions of dead bacteria, when injected into the general circulation, were found in the liver, and also in wandering phagocytes in the glomeruli of the kidney. None were found in the endothelial cells or in the submucosa of the pelvis, either when the ureter was ligated or when free.

CONCLUSIONS

1. We have found that foreign particles, in small doses tend to pass readily through the kidney circulation, without lodging.

2. Larger doses tend to lodge in the glomerular capillaries and the capillaries of cortex and medulla. The greater part of this ink clears in several hours.

3. Emboli which lodge in the glomeruli bring about an acute glomerulitis. The injury is usually temporary, and complete restitution to integrity occurs.

4. When the embolus is permanent, degeneration of the tubules occurs and an infarct is produced.

5. The glomeruli most commonly and most easily plugged are the terminal glomeruli of the interlobular arteries immediately beneath the cortex of the kidney, the location clinically of the commonly seen septic infarct.

6. The endothelial cells of the capillaries in the glomeruli, have the property of picking up particles, if the dose injected is suitable.

7. The endothelial cells of the capillaries beneath the pelvic mucosa and certain fixed and wandering cells in the submucosa occasionally pick up particles of ink.

8. When, on the other hand, the ureter has been ligated and a definite hydronephrosis has developed before the injection of ink, then there is a very marked deposition of ink in the submucosa of the pelvis and in the tip of the papilla. Increased amounts of ink are picked up by the endothelial cells and phagocytic cells in the pelvic submucosa.

9. Similarly under these same conditions particles of ink are seen in the epithelial cells of the pelvic mucosa. Denuded epithelial cells containing ink were found in the contents of the hydronephrotic sac.

10. The deposition of ink in the papilla and submucosa of the pelvis, under conditions of back pressure, are similar to the clinical findings, found in pyelonephritis.

11. It is too early as yet for us to report fully on the lesions obtained experimentally, with living and dead bacteria.

We wish to thank Dr. John Tait, Professor of Physiology, McGill University, for many valuable suggestions during the course of these experiments.

EXPERIMENTAL

The following are examples of typical experiments carried out in the injection of india ink particles, of which 95 were done.

Protocol I

Rabbit, 2 kilos, injected with 20 cc., 1:4 dilution of ink in marginal ear vein. The mucosa of lips, eyes, etc., became darkened, and the

veins of both ears became a dark purplish color. The animal was killed in fifteen minutes. On opening the abdomen the liver and spleen were definitely a purplish black. The vessels of the intestine and mesentery were darkened.

The kidneys were a purplish black, both of similar color and appearance. On cut section, the kidney surface was a dark reddish black. Both cortex and medulla were a similar color. There were no inflammatory streaks in the medulla and the submucosa beneath the pelvis seemed somewhat darkened.

Microscopically, there was a large amount of agglutinated ink particles in the kidney. It was all, as far as could be seen, in the blood stream. It had not been taken up, as yet, by any kidney cells.

In the cortex, it was in the glomeruli and its afferent and efferent arteries. The intertubular arteries of the cortex and medulla contained similar quantities of ink particles. Part of these particles were already picked up in the blood stream by phagocytic cells and leucocytes. In the glomeruli, the majority of the loops of the capillaries were filled with ink. The remainder were packed with red blood cells. There was very little outpouring of albumen into the intracapsular space of the glomeruli. No casts or ink particles were noted in the tubules.

Ink was also seen in the capillaries beneath the pelvic mucosa. The microscopical picture of both kidneys was similar.

Protocol II

Rabbit, 2000 grams, injected intravenously with 20 cc. of a 1:4 dilution of ink and killed in four hours.

The original black appearance the sclera and mucosa had passed off. On opening the abdomen the liver and spleen were definitely black. The vessels of the intestine and mesentery, had lost the purplish black appearance seen in case I at fifteen minutes.

The kidneys were a purplish black color, both similar in appearance. On cut section, the cortex was of a much darker color than the medulla. There was only a very slight darkening of the medulla, and of the tissues about the pelvis, whereas the cortex showed innumerable black specks dotted throughout. It was noted that the outermost ring of glomeruli, just under the capsule, were markedly darkened. It would almost seem as if these glomeruli bore the brunt of the invasion of particles.

Microscopically, the ink was found mainly in the cortex with only a few particles in the capillaries of the medulla. The particles in the

vessels in the medulla, were for the most part in phagocytic cells, but some were adherent to, or partly in endothelial cells of the vessel wall.

In the cortex the ink was mainly in the afferent and efferent arteries to the glomeruli, and the intertubular capillaries. The mass of ink made it impossible to tell whether any ink was in the endothelial cells. The loops of the glomerular tuft were packed with red cells, and agglutinated ink particles. There was some swelling of the glomerular loops and an outpouring of albumen into the intracapsular space, and the convoluted tubules contained albuminous casts.

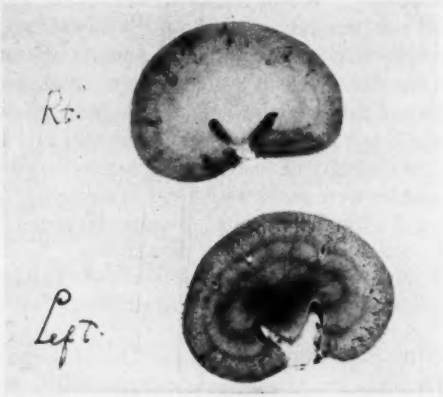

FIG. 4. Cross section of right and left kidneys following injection of ink (Protocol III). The left kidney removed in twelve hours. Right kidney four days later. The greater portion of ink seen at twelve hours in the cortex and medulla, as well as the inflammatory reaction in the cortico-medullary region, have disappeared in four days in the right kidney.

In and about the areolar tissue around the pelvis, were seen phagocytic cells—evidently wandering cells in the capillary blood stream. No particles were seen picked up by any fixed tissue cells.

The bladder contained 1 ounce of dark colored urine containing albumen, red blood cells and hyaline casts.

Protocol III

Rabbit, 2000 grams, injected with 20 cc. of 1:4 dilution of ink intravenously. The left kidney was removed under ether anesthesia in

twelve hours. The animal allowed to recover and then killed four days later.

The left kidney, twelve hours after injection, was a reddish black color. The medulla showed a very slight amount of darkening, though there were marked reddish streaks leading down from the cortex to the

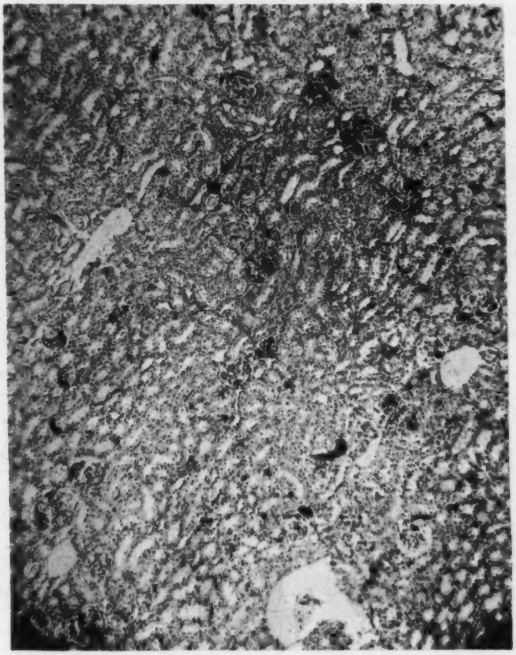

Fig. 5. Micro-photograph (low power) of cortex of left kidney seen in figure 4. Ink present in glomeruli and intertubular capillaries.

papilla. The cortex was definitely blackened with innumerable black points—ink-studded glomeruli.

Microscopically, the ink was mainly in the glomeruli and its immediate afferent and efferent arteries. Ink was also in the intertubular arteries between the proximal convoluted tubules, but to a much less extent. The amount of ink in the cortex was much less than that seen at four hours in case II.

The majority of the glomeruli near the cortex contain some ink. They appear swollen and engorged with red blood cells and leucocytes, many of the latter containing a few particles of ink. Many glomeruli appear entirely disorganized showing hyaline degeneration and fusion of the capillary loops. The capsular space is in many instances completely filled with albumen. A moderate number of the tubules show albuminous casts. In some areas immediately surrounding a glomerulus, completely blocked, the tubules show marked degeneration, the lining

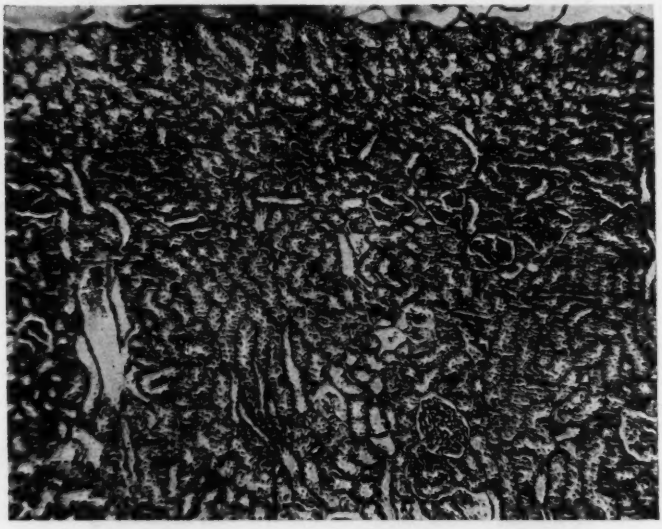

FIG. 6. Micro-photograph (low power) of cortex of right kidney (figure 4) showing lessened amount of ink in glomeruli and capillaries after four days interval.

cells being cast off with the formation of epithelial casts. Occasionally a glomerular loop shows rupture with an escape of ink particles into the capsular space. Some of the endothelial cells of the glomerular and intertubular capillaries contain fine ink particles.

The capillaries of the medulla are engorged but contain very little ink. In the loose areolar tissue about the pelvis, there is an occasional particle of ink in a wandering phagocyte, also in a few endothelial cells of the capillaries.

The right kidney examined four days later shows a reddish black kidney surface, smooth and slightly larger than the left kidney, and more engorged with blood. Cut section shows a kidney somewhat redder, but less black than the left kidney. The ink studded glomeruli

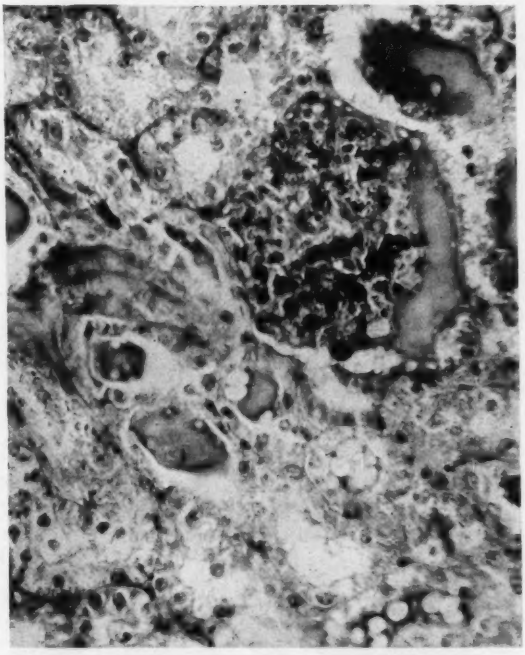

FIG. 7. Micro-photograph (high power) of cortex of kidney, twelve hours after injection intravenously of 20 cc. of 1:4 ink, showing glomerulus partially blocked with agglutinated ink particles. There is swelling of the capillary tuft and an outpouring of albumen into the capsular space and convoluted tubules.

are less prominent. The medulla is paler and there is not the same inflammatory reaction in the medulla and papilla.

The pelvis and peri-pelvic tissues are a normal color. Microscopically, the right kidney shows less ink than the left kidney removed four days previously. There is roughly half the amount of ink in the cortex as compared with the left side.

Very few of the glomeruli are completely blocked. The emboli seen on the opposite side in the capillaries are much less in size and amount. There is not the same degenerative changes in glomeruli or tubules. Certain areas contain plugged glomeruli with tubules containing casts, and some of these tubules are entirely denuded of epi-

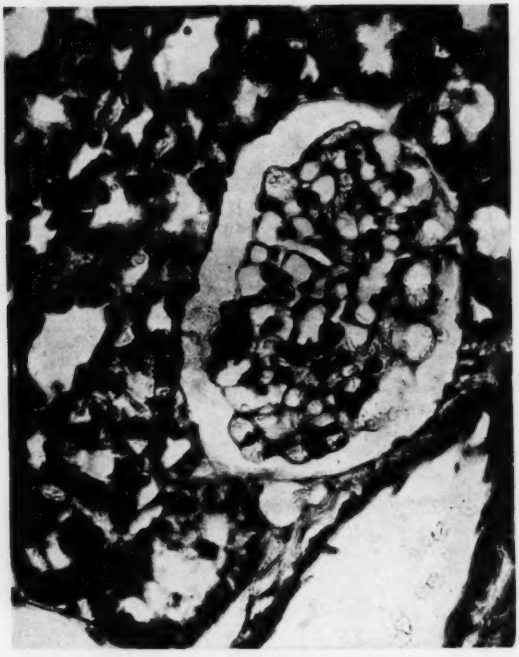

FIG. 8. Micro-photograph of glomerulus as in figure 7, showing embolus of ink in capillary loop, with localized reaction and outpouring of albumen.

thelial lining. The remainder of the glomeruli and tubules appear normal.

Endothelial cells of glomerular loops contain fine particles of ink, as do also the endothelial cells of capillaries both in the cortex and the medulla.

There are hardly any ink laden cells in the loose areolar tissue beneath the pelvis. From other experiments we have seen that both kidneys receive the same amount of ink. So that from the lesser amount found

in the right kidney 4 days after the left has been removed, we must assume that the ink has been carried off by phagocytic cells in the blood stream.

Protocol IV

Rabbit, 1800 grams, was injected with 20 cc. of a 1:10 ink solution in the marginal ear vein. This was repeated twice at daily intervals,

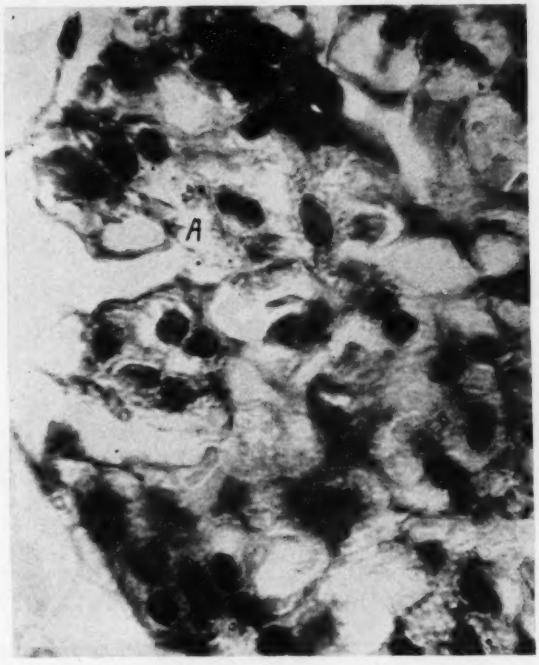

FIG. 9. Micro-photograph (high power) showing fine granules of ink in endothelial cells of glomerulus, at *A*, three months after injection of ink (Protocol IV).

three injections in all. The urine collected at the end of the third day, showed red blood cells, albumen+, and hyaline casts.

The animal was killed in three months, it was thin, but otherwise in good condition.

On opening the abdomen, the liver and spleen were seen to be dark

in color. Some blackish dots were present in the omentum. The kidneys were of normal color and appearance and were similar in all respects. The capsule of each stripped easily. The cut surface was of normal color with a few black dots scattered throughout the cortex. The medulla and pelvis appeared normal grossly. Microscopically,

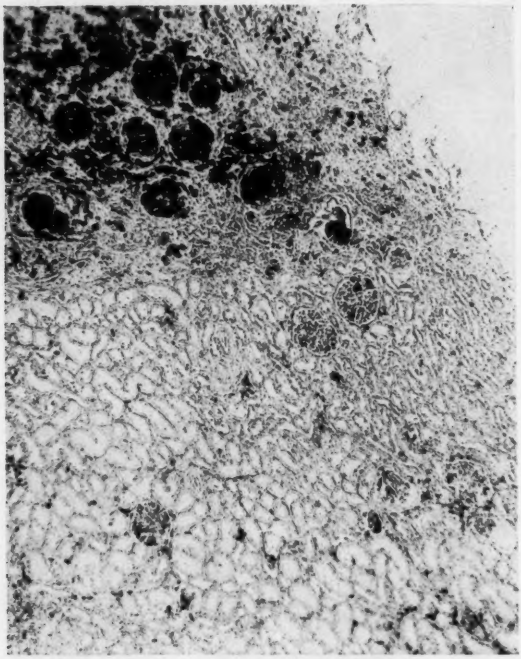

FIG. 10. Micro-photograph (low power) showing plugged capillaries and glomeruli in cortex of dog's kidney, and consequent degeneration and replacement by scar tissue (Protocol VIII) remainder of kidney tissue practically normal.

there is a very slight amount of ink seen. The ink as seen grossly is mainly small emboli in the intertubular capillaries of the cortex. There is a lesser amount in the glomerular tufts. That in the tufts is composed of individual clumps in one of the capillary tufts. There does not appear to be any local reaction to this foreign body. There is no

proliferation of cells, or outpouring of albumen and no acute tubular degeneration. There are scattered areas about glomeruli completely plugged showing replacement by scar tissue.

Under oil immersion lens, small particles are seen in the endothelial cells of the capillaries both in the glomeruli and in the intertubular

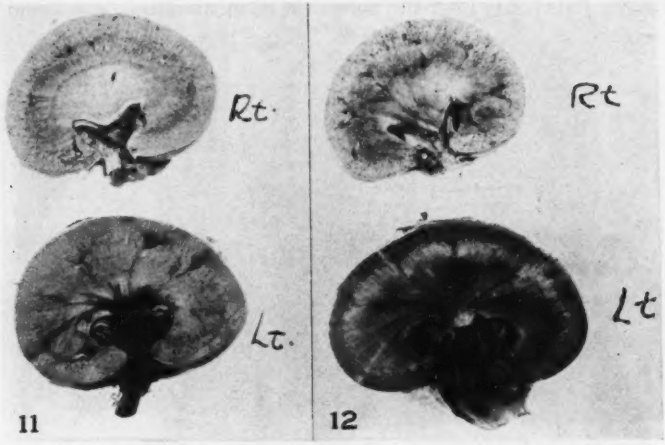

FIG. 11. Longitudinal section through kidneys described in Protocol V. Lower kidney with hydronephrosis of three days duration, previous to intravenous injection of ink. Note marked deposition of ink in papilla and in submucosa of pelvis in lower kidney and comparative absence in upper kidney.

FIG. 12. Similar experiment as in figure 11 with larger injection of ink intravenously. Increased general deposition of ink in right or upper kidney, with greater deposition of ink in left or ligated kidney, both in cortex, papilla and submucosa of pelvis (Protocol VI).

capillaries. No ink particles were found in the capillaries beneath the pelvic mucosa, though an occasional fixed cell in the loose areolar tissue, contained an ink granule.

Protocol V

A male rabbit, 2400 grams, was used. Under ether anesthesia, through a mesial transperitoneal incision the left ureter was doubly ligated 1½ inches from the pelvis and divided. Both kidneys appeared of equal size and similar in color and appearance.

On the third day following ligation of the ureter, the rabbit was in good condition. An injection of India ink was then given in the marginal ear vein. This was 20 cc. of a 1:10 dilution of Pelican ink made up in 0.9 per cent saline and filtered through hard filter paper. The sclerae and mucous membranes of eyes, and the tongue and lips became noticeably a blackish blue color. This passed off in several hours.

Twenty-four hours later the animal in good condition, was killed by chloroform.

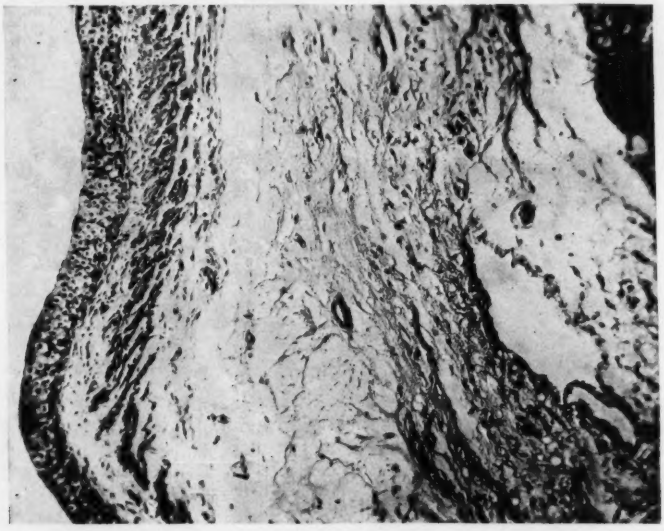

FIG. 13. Micro-photograph (low power) of submucosa of right kidney (figure 11) twenty-four hours after injection of ink. There is comparatively little deposition of ink in the submucosa of the pelvis.

On opening the abdomen the liver and spleen were seen to be markedly darkened. There were dark streaks of ink in the omentum.

The right kidney was of normal size and appearance.

The left kidney was enlarged, congested and slightly darkened on its surface with ink. The pelvis was dilated and contained 3 cc. of dark brown stained fluid and several small blood casts. This contained red blood cells and epithelial cells. No free ink was seen in the centifuged specimen.

On section, the right kidney was reddish in color, and the medulla pale. A few fine specks of ink were noted throughout the cortex. No darkening of ink noted grossly about the papilla or the pelvis or calyx. On the other hand the left kidney showed a slightly greater speckling in the cortex with ink and a marked darkening with ink in the

FIG. 14. Micro-photograph (low power) of pelvic wall and submucosa in left or ligated kidney, figure 11. Note deposition of ink in capillaries beneath the epithelium of the pelvis and in the fixed tissue cells in the submucosa.

papilla and under the pelvic mucosa of the calyces and the pelvis proper and about the uretero pelvic junction.

The left kidney was much more engorged than the right and there were reddish inflammatory streaks leading down from the cortex to the medulla.

Microscopically, the cortex of the right kidney showed a relatively

small quantity of ink in the glomeruli and the intertubular capillaries. Only the occasional particle of ink was seen in the intertubular capillaries. There was only the occasional particle of ink noted about the the pelvic submucosa. These were in the endothelial cells of the capillaries, and in wandering phagocytes.

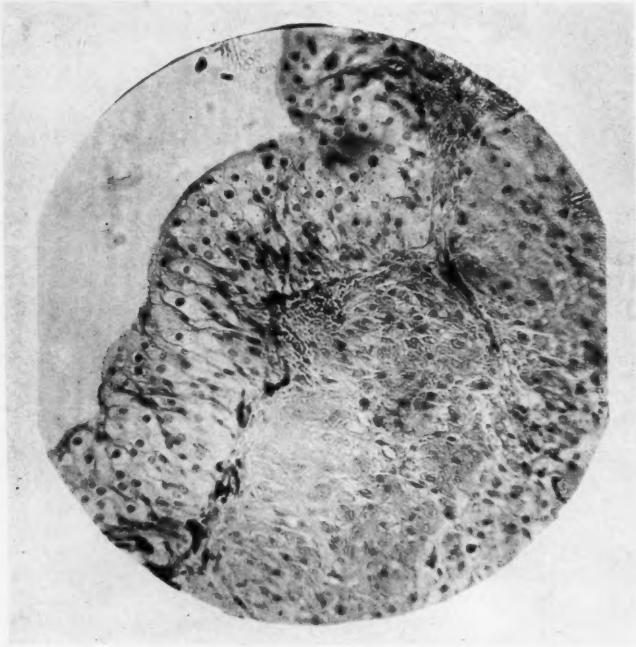

FIG. 15. Micro-photograph of pelvic mucosa in left kidney, figure 11. Note deposition of ink in submucosal capillaries, also as fine granules in the epithelial cells of the pelvic mucosa.

The distribution of ink in the cortex was mainly as coagulated particles in the capillaries of the glomerular tuft and the intertubular capillaries. Small particles were also taken up by the endothelial cells of the capillaries of the glomeruli and the intertubular vessels.

Whereas in the left kidney there was an increased amount of ink in the cortex and medulla, and also a marked increase in the tip of the papilla and in the tissues beneath the pelvis and calyx.

In the papilla the great mass of ink was in the intertubular capillaries. Some of the smaller particles were taken up by the endothelial cells and some particles were merely adherent to them. There was a general dilatation of the tubules of both cortex and medulla.

About the pelvis there was a large quantity of ink in the capillaries

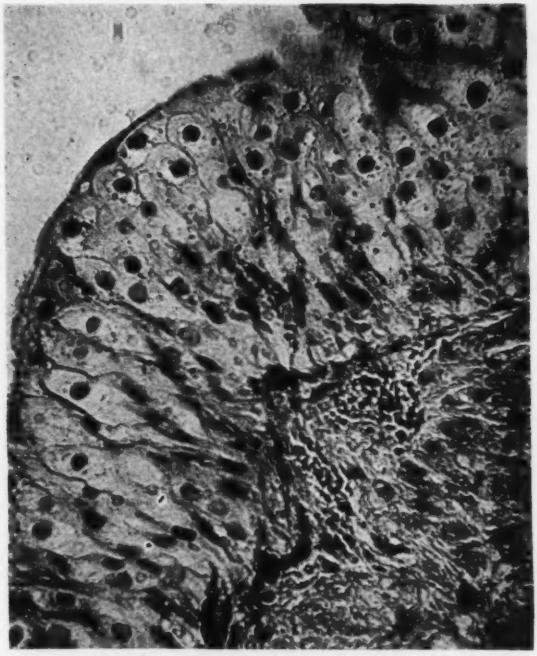

FIG. 16. Micro-photograph (high power) of section seen in figure 15. Ink granules definitely within the epithelial cells of the pelvic mucosa and in the capillaries at its base.

directly beneath the mucosa. This mass consisted of coagulated ink particles free in the capillaries, partly in phagocytic cells free in the circulation, and in the endothelial cells of the capillaries.

In the areolar tissue of the submucosa were ink particles in wandering phagocytes and in fixed tissue cells. This was in a much greater amount than seen in the right kidney.

Ink particles were also noted in the epithelial cells of the mucosa, at the junction of the pelvis proper and the calyx. These were definitely in the epithelial cells, and not in phagocytic cells, between the epithelial cells of the mucosa. The urine of the hydronephrotic kidney was centrifuged and contained red blood cells, a few clots of blood, but no

FIG. 17. Micro-photograph (high power), showing granules of ink picked up by pelvic epithelium of the left kidney, shown in figure 12.

free ink particles. Several epithelial cells were found which contained particles which looked like ink.

Protocol VI

Male rabbit, 2000 grams. Under ether anesthesia the left ureter ligated and divided through mesial transperitoneal incision, 1½ inches from the pelvis. The kidneys were similar in appearance. Three days

later 20 cc. of 1:4 dilution of ink in 0.9 per cent saline was given intravenously. The animal was killed twenty-four hours later. On opening the abdomen the liver and spleen were quite black. Ink was noted in the omentum. The bladder contained 1 ounce of urine which showed albumen and microscopically, a few red blood cells, and an odd hyaline cast. No ink was seen in these casts.

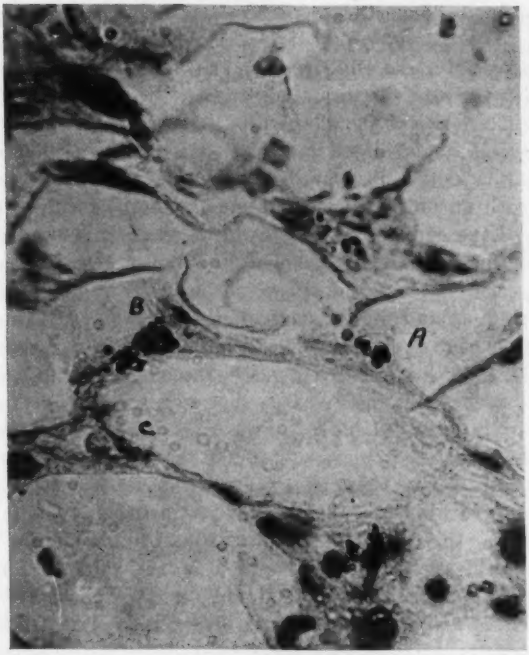

FIG. 18. Ink particles picked up by cells in the peripelvic tissue of the left kidney, shown in figure 11. Ink particles in wandering phagocytic cells at *A* and *B*, and in fixed tissue cells at *C*.

The right kidney was normal in size and appearance. The left kidney was enlarged to twice its previous size and was almost black in color. The pelvis was distended and also appeared dark in color.

On section, the cut surface of the right kidney was pale in color with a few fine black specks in the cortex. The medulla was pale and not ink stained. The pelvis was white and the submucosa grossly free from ink.

The left kidney or section showed a dark black ring of cortex. The whole cortex was ink filled. The medulla was apparently free of ink but showed radial inflammatory streaks leading down to the papilla. The submucosa of the pelvis, calyx and ureteropelvic junction showed a marked deposition of ink.

The urine in the hydronephrotic sac, microscopically, contained red blood cells, and hyaline and epithelial casts. Several of the hyaline casts contained ink particles. Several epithelial cells also showed ink particles.

Microscopically, the right kidney showed a scanty amount of ink deposited mainly in the glomeruli and in the intertubular capillaries and efferent arteries of the glomeruli. The ink in the glomerular tufts was partly, as agglutinated particles and partly in phagocytic cells. Several of the glomeruli showed an accumulation of red blood cells in the tuft with an outpouring of albumen into the intracapsular space. The cells of the convoluted tubules in these cases showed evidence of cloudy swelling, with hyaline casts in the tubules themselves.

Other areas appeared entirely normal. The outermost ring of glomeruli were more commonly affected.

Several ink-laden wandering cells were seen in the areolar tissue beneath the pelvis but no mass of ink was seen in these capillaries.

The left kidney, microscopically, showed a greater mass of agglutinated ink in the glomeruli both near the capsule and towards the medulla. The slowing of the circulation through the kidney by the increased pelvic pressure evidently allowed a greater deposition of ink. The great mass of this ink was as agglutinated particles. The ink was also intracellular, both in the endothelial cells and in wandering flagocytes. Agglutinated particles were numerous in the afferent and efferent arteries of the glomeruli and in the intertubular capillaries of the cortex and to a lesser extent in the medulla except at its tip where ink was again prominent. There was a generalized dilatation of the tubules in both cortex and medulla. There was no marked swelling of the glomeruli nor degeneration of the tubules as seen in other cases where emboli caused acute inflammatory change.

About the pelvis the ink particles were deposited in great quantity in the sub pelvic capillaries and also in the fixed fibrocytes and wandering phagocytes in the loose areolar tissue. Ink granules were also noted in the pelvic epithelial cells, about the junction of the pelvis proper and the calyx.

Ink laden casts were found in the contents of the pelvis as were also

epithelial cells containing fine particles of ink. It is impossible to say if free ink was seen or not. A few fine black particles were seen in the slide of the centrifuged contents, but not in sufficient quantity to be identified as ink particles.

Protocol VII

Dog, 18 pounds, under ether anesthesia and through left loin incision. The left renal artery injected with 20 cc. of a 1:20 dilution of ink 0.9 per cent saline. During the injection the whole kidney became a dark purplish color. Almost immediately after the injection ceased the normal color returned. There was no swelling of the kidney during the injection.

Urine before operation was normal. On day following showed albumen trace and few red blood cells, no casts. One week later animal killed. Urine showed no albumen, red cells or casts.

On examination both kidneys appeared similar in appearance. On cut section, the right kidney showed normal markings and the left kidney was similar. There were no deposits of ink noted grossly.

Microscopically, the left kidney showed an occasional embolic particle of ink in a glomerular tuft. No ink was noted intracellularly. No ink was noted in the right kidney. Ink was found in both the liver and the spleen.

Evidently the dose used in this case was of too great dilution to cause any embolic formation in the glomeruli. The ink was evidently carried through the kidney and picked up by the reticulo-endothelial system.

Protocol VIII

Dog, male, 32 pounds. Ether anesthesia. Through a left loin incision the kidney was exposed, and 20 cc., of 1:4 dilution of ink in 0.9 per cent saline injected into renal artery. The hole in artery was oversewn with muscle tissue. During injection the whole kidney surface became black. The red color returned somewhat when injection stopped. The left kidney measured 5 by 3 by 2 cm. The urine on day of operation was normal. On the following day it showed albumen +, red blood cells, and granular casts. No ink was seen in these casts.

Urine examined at intervals of one week showed gradual diminution in albumen, red blood cells and casts. Animal killed in fourteen weeks, had lost 3 pounds, and the urine showed no albumen, red blood cells or casts.

On opening abdomen, liver and spleen grossly showed ink.

The right kidney was of normal color and on section showed normal markings. The size was 6.2 by 3.6 by 2.5 cm. The size before operation was not known. The left kidney was small, 4.5 by 2.5 by 1.8 cm. —dark purplish in color and on cut section showed irregular blotchy patches on the cortical surface of the kidney, typical depressed infarcts. These ran in a wedge shaped area down to the medulla of the kidney. Apart from these infarcts were scattered fine black dots, more marked near the surface of the kidney than towards the medulla. These were ink studded glomeruli.

Microscopically, the right kidney contained an occasional particle of ink carried to it by the blood stream. These were in the glomerular afferent arteries and in the glomeruli. No apparent changes accompanied these particles, which were free emboli.

The left kidney, microscopically, showed a varied picture. The depressed black areas, seen grossly, were typical infarcts, the tubule cells having degenerated and been replaced by scar tissue. The glomeruli were intact and absolutely filled with agglutinated ink particles, as were also the cortical capillaries. The medulla leading down from this cortical infarct showed degenerative changes and had been replaced by fibrous connective tissue.

The remainder of the kidney showed almost normal kidney cortex and medulla with occasional particles in the capillaries of the glomeruli and in the intertubular capillaries. Particles had been taken up by the endothelial cells in these glomeruli and in the intertubular capillaries, though the majority of ink particles were emboli formed of agglutinated ink particles.

Protocol IX

Rabbit, male, 2000 grams, under ether anesthesia the left ureter was ligated, through a mesial transperitoneal incision. Three days later 20 cc. of a killed culture of staphylococcus aureus was injected in the marginal ear vein. The culture was a forty-eight hour culture grown on 6 slant agar tubes and washed off in 200 cc. of saline.

The rabbit was killed in twenty-four hours. Apart from the hydronephrosis of the left kidney and its consequent changes, nothing abnormal was noted.

Microscopically, the cocci were found in the Kupfer cells of the liver and in wandering phagocytes in the glomerular tufts of both kidneys, although more marked in the left. No cocci were found in endothelial cells or in cells beneath the pelvic mucosa.

The same technique was used with a similar preparation of killed culture of B. coli communis and the same findings obtained. No bacilli were found in the submucosa of the left kidney.

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REPORT OF A CASE OF BILATERAL KIDNEY CALCULI

CHARLES H. CHETWOOD

The patient, a well nourished male, thirty-two years old, entered the hospital for examination on November 17, 1926.

General complaint. Pain, more or less constant, in left lumbar region.

Gross urine analysis. Showed scattered uric acid crystals, moderate amount of pus, and red blood cells.

Cystoscopy. Both ureters catheterized. Specimen obtained from *left* kidney; no urine obtained from *right.* Laboratory analysis of left kidney specimen shows a number of pus cells, but nothing further pathologically.

Roentgen findings. Films of the urinary tract show both kidneys to be normal in size and location. On the left side is an irregular shadow in lower pole of *left* kidney about 2 cm. in length and 0.5 cm. in width. Also an oblong calculus in the ureter of the *right* kidney, about the level of the third and fourth lumbar vertebrae. Confirmatory films were made with opaque catheters in situ, a pyelogram of the left side, and subsequently a ureterogram of the right.

In surgical conference, the question of the proper procedure in the foregoing case was discussed. There seemed then to be the sentiment in favor of attacking surgically the right side first,—namely, that with the mobilized ureteral stone. The opposite course, however, was decided upon on account of the normal excretory function of the left kidney containing the encapsulated calculus, the absence of pain on the opposite side, and the hope of obtaining the ureteral calculus without operation.

Operation. Left nephrotomy, with removal of a pyramidal-shaped articulated calculus from the lower pole by counter-pressure through the pelvis. A tube was inserted into the kidney for drainage as well as to insure unhampered functional activity. The wound healed eventually without fistula.

Subsequent treatment was directed to the opposite (right) side with the purpose of aiding descent of the ureteral calculus. This occurred, as shown in the films, in progressive stages, and the stone was ultimately passed into the bladder and out of the urethra without any attendant symptoms.

While the dictum of attacking the better functionating kidney in the case of bilateral calculi is more or less a popular one, yet this course cannot always be adopted. A brief summary of the variable conditions that exemplify this fact is as follows:

1. Where conservative operation is performed on both kidneys, the indication being double calculus pyonephrosis, and where little more than an effort to institute drainage is undertaken with perhaps only partial calculus removal. Such cases are extreme ones, accompanied by high fever and pronounced pyuria. While operation may be deemed hazardous, it may be the best way out of a bad situation.

2. Where there is advanced calculus pyenophrosis demanding immediate nephrectomy or drainage owing to constitutional symptoms: Secondary pyelotomy, or pyelotomy and nephrotomy, is performed later for removal of stone from opposite side.

3. Bilateral stone with pyelonephritis and no pronounced difference in the pathology or function of the two sides. Removal of calculi in two separate operations without discrimination.

4. Bilateral stone kidneys with pronounced difference in both the pathology and excretory function of the two kidneys: where the worse kidney is attacked to permit nephrectomy if expedient. In such cases the risk of stone blockade on the opposite side must be given due weight.

5. Bilateral stone kidneys with a determined difference in the two sides: where the better kidney is attacked first to conserve to the maximum its function before operating upon its less capable mate. As between a moderate hydronephrotic kidney on one side and a lower phthalein function on the opposite side, the latter would be classified as the poorer kidney in most instances.

6. Bilateral lithiasis involving one side kidney calculi and ureteral calculus on the opposite side. Here action is varied with the existing pathological conditions and apparent mobility of the ureteral stone. Prompt removal of the ureteral stone by non-operative methods is always desirable when possible Various effective means to this end are fortunately now available. In the case reported the opposite course was taken to safeguard the

normally functioning kidney rather than to wait upon the delivery of the ureteral stone, which proved to be slow in transit.

7. Non-intervention. The existence of silent or non-symptomatic calculi in one or both kidneys is sometimes considered the justification for inaction. The rule for such a decision cannot be standardized, as each case must have individual peculiarities to determine the course of procedure. As to the proper time to operate upon bilateral renal calculi in general, cases might be cited wherein postponement of operation is decidedly conservative of life, as in the case of uremia that yields to preliminary treatment. On the other hand, operation unduly deferred may result in hopeless destruction of an organ that might have been salvaged by timely operation.

This report of a single case of bilateral calculi, insignificant in itself, directs attention nevertheless to the well recognized importance of bilateral urinary lithiasis and may elicit from the extensive experience of others in this field some profitable information on the subject.

DISCUSSION

Dr. Benjamin S. Barringer (New York): I think Dr. Chute has presented a very interesting paper on pain in the spleen stimulating pain in the kidney.

I recently had a patient who had lost 20 pounds in weight and who had a good deal of pain in the right kidney region which was diagnosed as probably hypernephroma. We got a pyelogram which was normal. We found by the history that the patient had been drinking a quart of alcohol daily and we made a diagnosis of cirrhosis of the liver, perispleenitis and no hypernephroma.

Dr. Vincent J. O'Conner (Chicago): About six years ago I was called to see a Chicago physician who had had several attacks of very profuse hematuria. At the time I examined him, the urine was clear and urological examination was absolutely negative. Pyelograms made at separate sittings were negative. At this time the outline of the spleen was very much enlarged and, while there was no diffuse calcification, the shadow of the entire organ seemed to be considerably denser than usual. This man came from the tropics and had chronic malaria. About two weeks afterward, he again had profuse hematuria, at which time I saw him, and found that the bleeding came from the left ureter. Previous functional studies had been normal on the left side.

The only conclusion I could draw from the findings was the possibility of congestion in the left kidney with pressure from above by this enlarged fibrotic spleen. The patient went on for some three or four months and finally the general surgeon who had him in charge, decided to do a splenectomy, and the spleen was removed—a chronic, fibrotic spleen about three times normal size. That was something over five years ago. The patient has since had no hematuria, no urinary symptoms; I see him frequently and he is perfectly well.

The only conclusion I could draw from this case was that there might have been a possibility of a chronic or acute passive congestion set up from time to time by pressure on the left kidney from this large, fibrotic spleen.

Dr. GEORGE R. LIVERMORE (Memphis): Speaking of bilateral calculi, I would like to show a plate of bilateral calculi in a woman aged seventy-two years who came to me with one large calculus in one side and a large one in the other. We treated her by irrigation of the kidney pelvis because we did not feel that she could stand any operation. Both kidney functions were very poor. She passed out of our sight for two years and when she came back, the calculus on the right side had grown to about three times its original size and the other had enlarged considerably.

My second case is a case of bilateral calculi not only of the kidney pelvis but also of the ureter with multiplicity of calculi in the ureters—if you can see it here. It looks like a Santa Claus stocking with an apple and a peach and an orange and toys packed in it. There must be fifteen or sixteen on the right side and eight or ten of the left. We have cut the end of her left ureter with Bumpus' scissors—and, by the way, it is a very satisfactory little instrument—and we dilated with the Livermore instrument, which, by the way, is another instrument which is very satisfactory. We have gotten ten stones from this woman but unfortunately they all have not come from the same side. Our idea is to clean out one ureter entirely and then take the stones out of the kidney on that side and get one good kidney. We can then play along with the other one.

Dr. J. DELLINGER BARNEY (Boston): I was very much interested in Dr. Chute's observations on splenitis. It recalled to my mind a case we had eight or ten years ago. I cannot remember the details but it may be worth recording.

The patient came in with evidences of an inflammatory process in the left loin and after some discussion with our staff and with the surgical staff it was decided the patient probably had a peri-

nephric abscess. The patient was operated upon. No actual abscess was found but paranephritis which did not look like the usual paranephritis. There was something queer about it.

The patient eventually died. At autopsy we found a large abscess of the spleen with tremendous adhesions and almost complete destruction of the organ, which apparently was the cause of the left-sided pain and tenderness and so on.

Dr. HERMAN L. KRETSCHMER (Chicago): The question of differential diagnosis between lesions of the spleen and lesions of the kidney comes up rather frequently and I wish to mention a case that recently came under observation, in which a diagnosis of infarction of the spleen had been made. A urological examination was asked for in order to rule out a possible kidney lesion. Because of the location of the tumor, namely, the left upper quadrant a renal possibility was considered. The case had so many interesting phases to it that I should like to mention it very briefly.

A woman, during pregnancy, developed a rapidly growing swelling in the abdomen. A diagnosis had been made of twin pregnancy although x-rays were not taken and after delivery one of the abdominal tumor masses still persisted.

A physical examination showed a tumor in the left side in the upper quadrant and in view of the fact that the left pyelogram was normal and the pelvic examination by a good gynecologist negative, the pathology was hooked on to the spleen. In view of the fact that this began with a sudden sharp pain, the diagnosis of infarction of the spleen was made. The patient was subsequently operated upon, the object of the operation being to do a splenectomy and at operation a large ovarian cyst was found with an unusually long thin pedicle.

Dr. EDWARD L. KEYES (New York): In reference to the bilateral stone case of Dr. Livermore, it has been my impression that in such a case a very satisfactory procedure, if other conditions permit, is a unilateral or bilateral pyelotomy for the purpose of fishing out such stones as you can get from the kidney pelvis

and calyces and attempting with wax bulb to fish more stones from the ureter, bringing them up to the kidney pelvis (which I have succeeded in doing occasionally). The taking off of the pressure by pyelotomy may permit the stone remaining in the ureter to be discharged into the bladder more readily than if that operation were not done. If they still stick they may be removed by ureterotomy.

Dr. ARTHUR L. CHUTE (closing): I have nothing to add. I am glad that other people have noticed this same condition. I am not sure whether or not that would account for the case which Dr. Kretschmer mentioned. I am rather inclined to think it would not.

Dr. DAVID W. MACKENZIE (closing): I do not know that I have anything to add, except possibly the wonderful ability of the kidney to recover and perhaps the fact that infection of the cortex of the kidney is more common than we suppose. Perhaps some of those adherent painful kidneys with normal renal pelves may after all, be due to old adhesions from superficial infections.

Another thing that impressed me in this work was the great amount of foreign material we found in the submucosa of the pelvis and almost down to the junction of the ureter. Whether the anatomy of the different small vessels that come off the renal arteries to those sections has something to do with it or not, I am not prepared to say.

A CONSIDERATION OF SUPRAPUBIC PROSTATECTOMY FROM THE STANDPOINT OF OPERATIVE TECHNIQUE AND POST-OPERATIVE CARE

JOSEPH F. McCARTHY

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Stimulated by the work in this field of endeavor, of our brilliant colleague, Dr. W. E. Lower, and freely availing myself of much of the excellence of his technical method, I am presenting here for your consideration the departures from his procedure, which seems to us perhaps more appropriate for our clinical environment.

From the standpoint of absence of post-operative complications, immediate or remote, the marked diminution in post-operative oozing, the complete absence of anything suggestive of disquieting bleeding, the comfort of the patient, and short domicile in the hospital; the results accomplished to date have proven incomparably superior to anything hitherto achieved at our hands.

It has always seemed to me that, with a median incision and the mechanical tractors available at this time, the exposure of the prostate and removal of the same, while the tractors are in situ, have not been altogether adequate for the purpose. To that end we are accustomed to employ the transverse incision in the bladder, as shown in figure 1. As seen in this plate it will be observed that the bladder wall is grasped with a Lower tenaculum just above the symphysis and another directly opposite. The incision at this point is made with a scalpel, the mucosa below, opened by a plunging procedure with the point of the scalpel, which may be enlarged either with the latter or with scissors, as shown in figure 2.

Figure 3 illustrates the method of retraction which is devoid of danger in the hands even of an inexperienced interne. This

traction has proven very satisfactory to us. A laparotomy pad is placed in the upper aspect of the bladder, extending out onto the

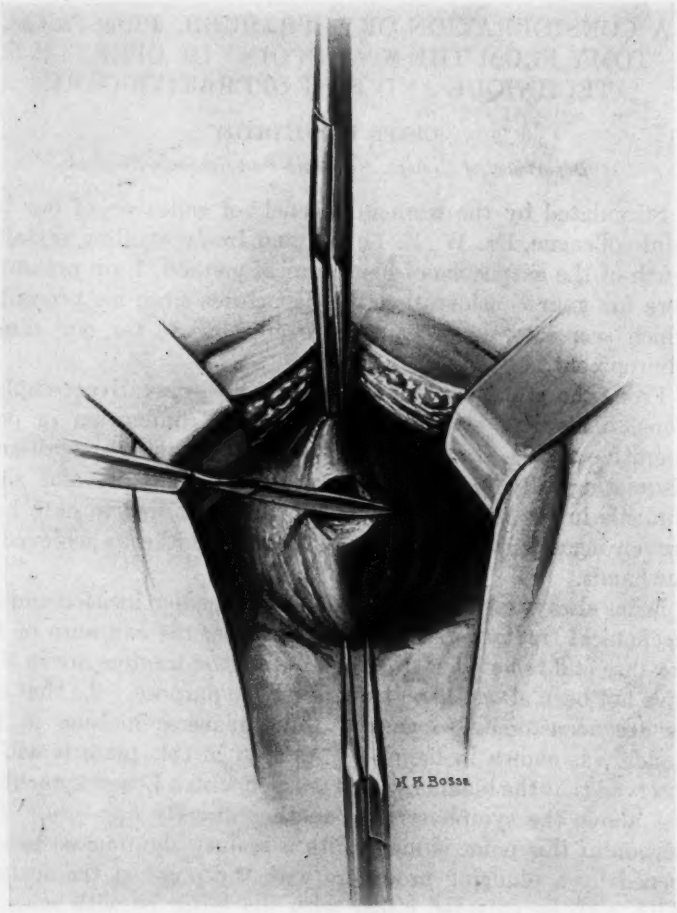

FIG. 1

abdomen and a large ribbon tractor placed in situ. There is no possibility of traumatism to the properitoneal structures, however

clumsily it may be handled. Laterally and anteriorly two Parker retractors are quite sufficient for this region. Following the removal of the prostate, which is of course done intra-urethrally without damage to the internal sphincter, as may be proven by post-operative pyelographic study (the method first advocated by Squier) the torn edges are grasped with the same Lower tenacula at five and seven o'clock, and the first suture, a mattress

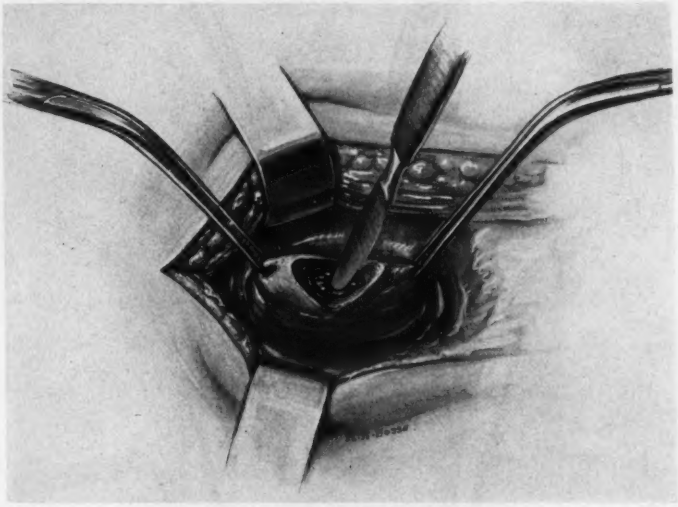

FIG. 2

one, introduced as shown in figure 4. Figure 5 is a line drawing illustrating the methods and points of suture. Prior to the abdominal incision, a No. 16 to No. 18 whistle tipped catheter has been introduced per urethra, as far as the bulb. When the hemostatic sutures have been placed, the catheter is introduced into the bladder and fixed, as shown in figure 6, with a zero or No. 1 plain catgut. The repair of the bladder is effected, as in figure 7, with a lock stitch. The drainage tube—illustration of which in this figure is somewhat disproportionate to the actual

size of the tube—is a No 28 or No. 30 French double eye tube. A snug repair should be made here to obviate peritubal leakage. A cigarette drain in the prevesical space, suture of the aponeurosis

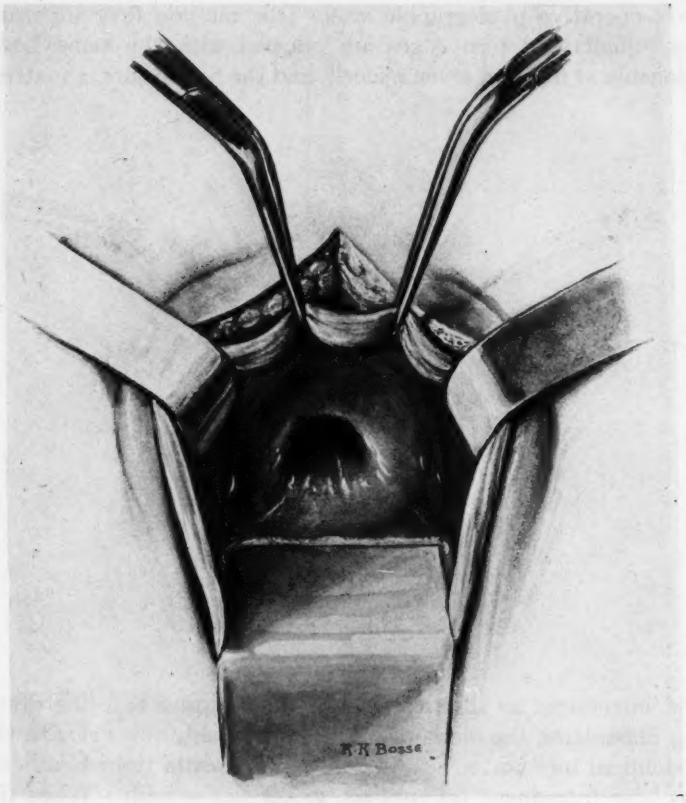

FIG. 3

and skin completes the operative steps. Immediate through and through irrigation is practised every hour or so for the first twelve hours. After seventy-two hours the urine is generally clear, the

suprapubic tube is withdrawn, the indwelling catheter remaining for two additional days. The suction apparatus which constitutes a routine part of our equipment, and which in my opinion will sooner or later be installed in every Urological

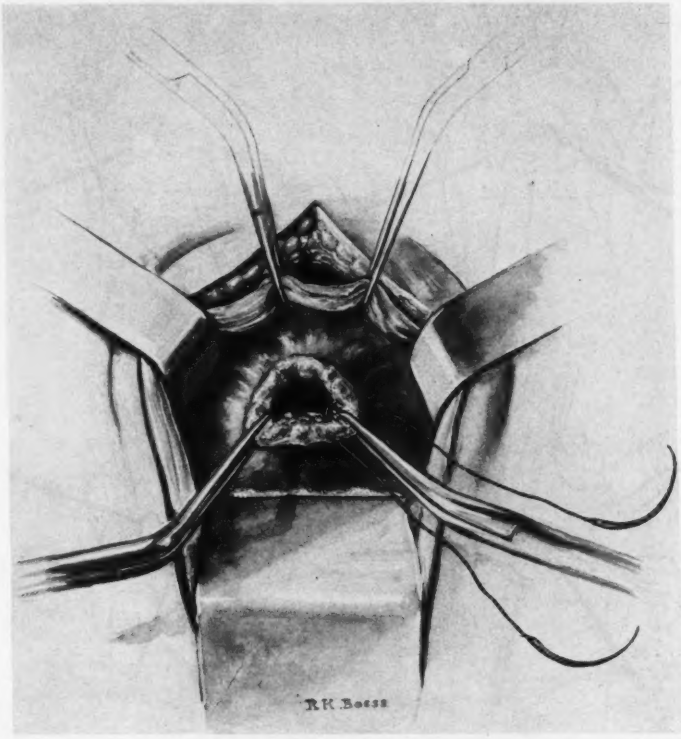

FIG. 4

private room and ward, is begun about the second day. This is well depicted in figure 8. Here we employ a modification of the Gile tube, which should be so constructed that no amount of pressure from whatever cause, will force it sufficiently deep as to interfere with the closure of the bladder. This tube keeps our

patient dry and odorless, at least insofar as urine is concerned. Convalescence: Since the introduction of the foregoing method has varied from six to fourteen days, with a general average of

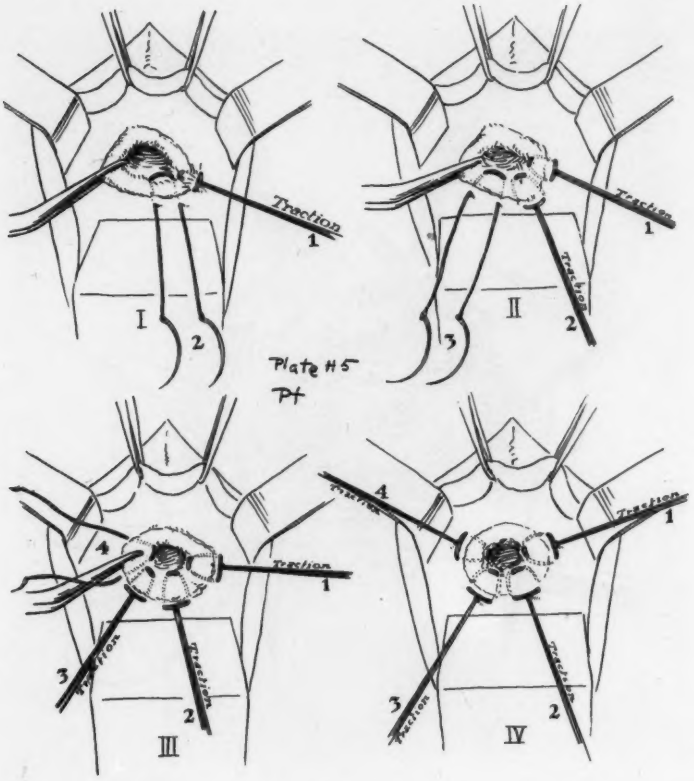

FIG. 5

about 12 days. Occasionally a case will carry on longer than fourteen days, but if it does investigation proves that our methods are not being followed, as with proper technique the wound promptly closes. There have been no sinuses. The results in

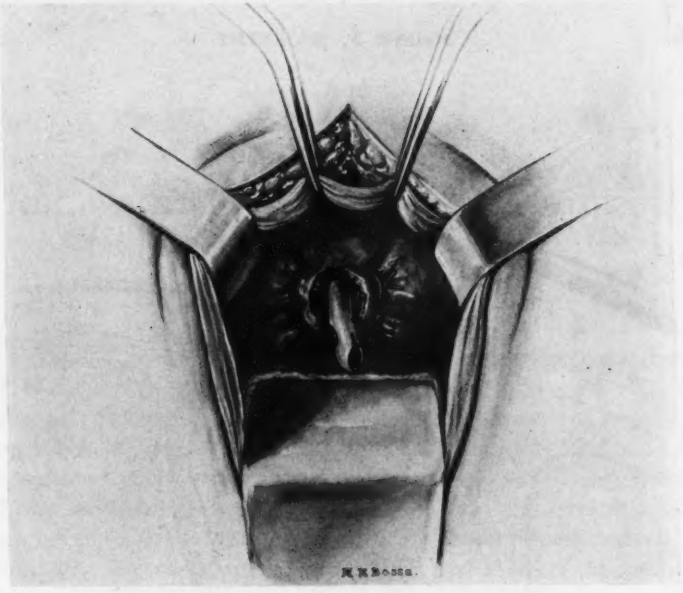

FIG. 6

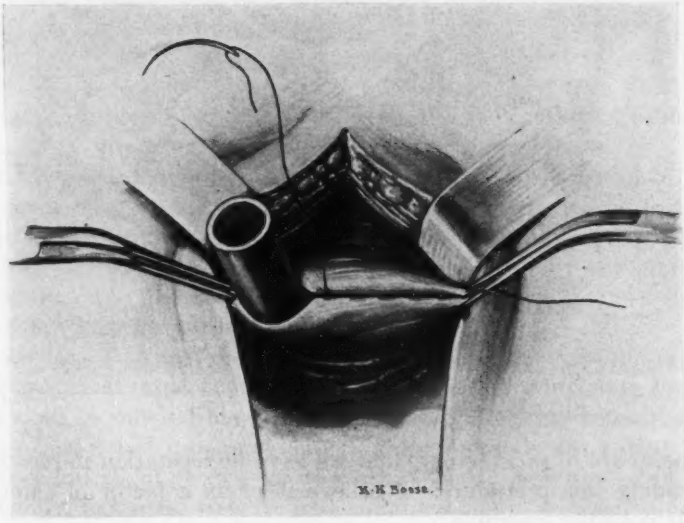

FIG. 7

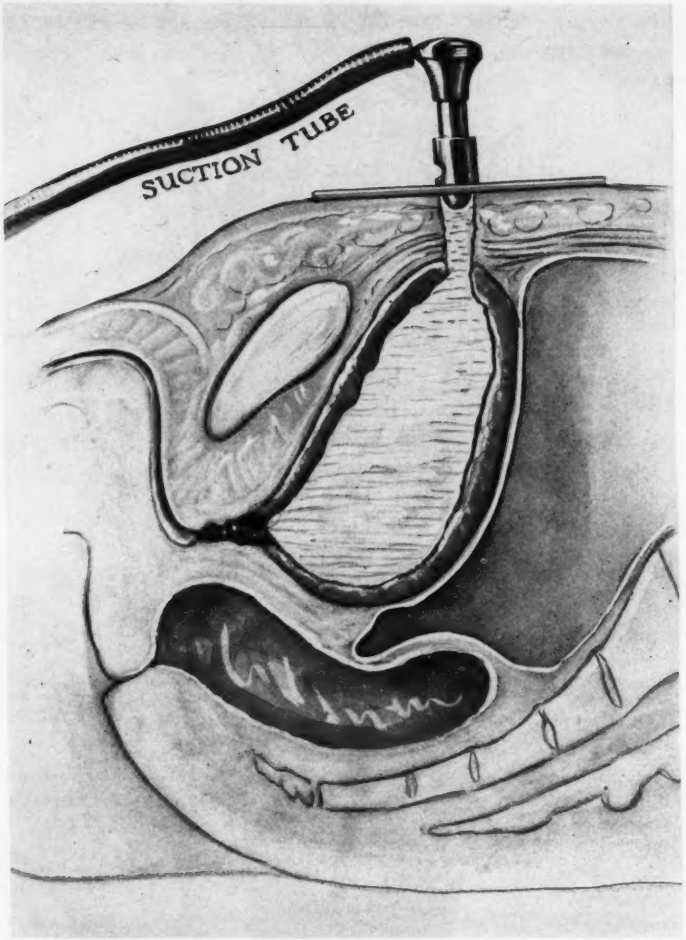

FIG. 8

general are so satisfactory, that we have no hesitation in recommending this procedure. I believe it offers a factor of safety that is highly desirable.

THE QUESTION OF HEMORRHAGE FOLLOWING SUPRAPUBIC PROSTATECTOMY AND ITS CONTROL

CHARLES H. CHETWOOD

In reviewing the literature, both native and foreign, contributed by those active in prostatic surgery, one is impressed with the divergence of opinion upon the question of hemorrhage and its control during suprapubic prostatectomy. On the one hand are those who minimize the danger of hemorrhage, who decry the use of any mechanical expedient to avert it, and who report a large number of expedients to support this claim; on the other hand are those who lay stress upon the possibility of hemorrhage and who employ preventive measures to insure as little bleeding as possible. It is my opinion that the arrest of hemorrhage during and its avoidance following prostatic operation are considerations of prime importance. This I believe to be the case notwithstanding an alleged very low percentage of mortality by those who consider blood-controlling agents unnecessary, for it is not the chance of mortality alone that makes the elimination of hemorrhage so important but its effect upon general constitutional vitality and convalescent wound reparation. In order to bring this question for general consideration, I am briefly describing the method of procedure followed in my clinic for many years past which has proved so successful that within the past ten years I am unable to find a case of hemorrhage of any importance, save one in which the method was not adopted.

Generally speaking, we find that the technique of the majority of urological surgeons involves the use of either tamponing gauze devices, or inflated bags for the purpose of checking hemorrhage associated with prostatectomy. These methods are varied by the addition of means for the insurance of pressure—such as clamps, ligatures, weights and counter-weights, rubber tubing.

silk thread, and guide wires. Personally, in the past decade I have not found it useful to have recourse to any of the special mechanical devices nor to adopt the inflated bag principle.

Hemorrhage following prostatectomy occurs within the capsule from the prostatic plexus and, in the case of middle or third lobe, from the vessels anastomosing across the posterior lip of the bladder. Therefore, where enucleation of bilateral lobes is involved it is my practice to tampon the capsule with specially prepared gauze, and this is employed almost without exception, sometimes reinforced with a single suture. Where there is a pronounced middle or third lobe extending into the bladder cavity, it is desirable to introduce a suture ligature on each side of same. The preparation of the gauze tampon is as follows:

About a yard of 1-inch triple folded gauze is unrolled under aseptic protection, immersed in a non-adhesive preparation and then stripped. This may be either mineral oil or balsam of Peru. Following this, both sides of the entire surface are dusted with a local hemostatic agent, such as pulverized gelatin or, lately, one of the modern physiological blood-clotting agents. It is then rerolled and is ready for use. The introduction of this gauze is a simple matter, as is its removal—simplified by virtue of the fact that it does not adhere to the denuded or granulating wound surfaces. It is removed in the course of twenty-four hours to three days, sometimes in stages. Within the last couple of years it has become an added routine custom to employ by intramuscular injections one of the modern physiological blood-clotting agents as a prophylactic both before and after operation. These agents are fibro-plastin, thrombo-plastin, coagulin, and clauden. It happens that the last preparation, clauden, is the one I have most frequently used

I might add that local and regional anesthesia form a part of our regular routine, viz., infiltration for preliminary drainage, and low intra-spinal block for the final operation.

The whole purpose of arresting hemorrhage is not alone to avoid mortality, but to safeguard physical resistance so far as is possible and to favor rapid convalescence; this, in my experience, has been best served by the measures just indicated.

PROSTATECTOMY UNDER LOCAL ANESTHESIA

H. G. HAMER

Indianapolis, Indiana

Several years ago local anaesthesia in prostatectomy was discussed in one of our urological meetings. At that time spinal and caudal anesthesia were being used by a few surgeons and the reports were quite variable as to the safety and satisfactory production of anesthesia by these methods. Since then spinal, caudal block and sacral block anesthesia have been used by many surgeons with satisfaction and it has been seldom that mention was made of infiltration anesthesia for operations on the prostate.

Nevertheless the fact that prostatectomy in all of its modern aspects may be done under this simple form of anesthesia and with a minimum of risk is justification for bringing the subject before you.

My preference in anaesthetics in urological surgery for a number of years has been gas-oxygen, and more recently ethylene, and I believe that if administered by a skilled anaesthetist there are no safer general anaesthetics. During recent years it has been my custom to perform prostatectomy, in a majority of cases, by the two-stage method, and it has been found convenient to do the preliminary cystotomy under infiltration anesthesia and the enucleation of the prostatic growth under nitrous oxide-oxygen or ethylene.

On several occasions in demonstrating, through the open bladder, an obstructing prostate to groups of students, it was observed that after block anesthesis of the lower abdomen there was very little sensation caused by the insertion of a bladder speculum, and that injections about the prostate with novocaine solution gave perfect anesthesia for removal of the growth. It was also observed that hemorrhage could be satisfactorily con-

trolled by suturing the prostatic cavity according to the technique suggested by Lower. This rather painstaking procedure could be carried out with deliberation unhampered by fear of too much general anesthesia.

There is no doubt in my mind as to the importance and value of sacral and spinal anesthesia in urology. The advances in overcoming the objectionable features of this form of anesthesia have in the past few years placed it in the first rank as an anesthetic in urological surgery. Nevertheless, we should not lose sight of the possibilities of local anesthesia in this work and its distinct advantage in cases unsuited for sacral or spinal.

G. Kolischer and J. A. Eisenstaedt, in 1917 described "A new method of Local Anaesthesia in Prostatectomy," using Schlesich's solution. In this article an excellent description of the nerve supply of the prostate is given as follows:

> The sensory nerves of the prostate gland are derived from the prostatic plexus often a prolongation of the vesical plexus which lies chiefly on the sides of the gland between it and the levator ani muscle. Each of the parts, right and left, supplies the prostate and prostatic urethra and sends branches to the neck of the bladder and the seminal vesicles. This plexus is made up of nerves of considerable size, which are derived chiefly from the sympathetic system through the pelvic or inferior hypogastric plexus, and from branches of the sacral ganglia and visceral branches by way of the pelvic splanchnics, from the second and the third, or third and fourth sacral spinal nerves. The vesical plexus presents on either side of the bladder, on a plane with the intramural portion of the ureter a flat ganglion from which emanate several ramifications, which perforate the bladder wall, surround the vesical end of the ureter, the prostate and the seminal vesicle, and form around each of these organs a secondary plexus, in the center of which are several ganglia some of the branches of which may be traced across the prostate, the adjacent urethra to the posterior part of the corpora cavernosa.

Local anesthesia for the suprapubic cystotomy is performed as follows: Morphia $\frac{1}{4}$ grain and atropine $\frac{1}{150}$ grain having been given hypodermically one hour before, a line of subcutaneous infiltration is made from the pubes to the umbilicus, and from the upper, middle, and lower extremities of this line the needle is

carried outwards to the right and left in several directions, penetrating the muscles of the abdominal wall and depositing the solution over a wide area on either side of the median line. Injections are then made beneath the fascia in the median line especially in the prevesical space where several cubic centimeters are deposited.

Cystotomy is then performed in the usual manner, and the bladder opened widely. Retraction by the use of the Balfour abdominal retractor or the Balfour-Judd bladder speculum, supplemented by a Deaver blade, will give good exposure of the prostatic tumor.

Injections are now made around the prostatic tumor and into it, the needle penetrating the capsule near the vesical orifice to be carried either along the prostatic urethra or around the tumor mass. Injections are also made to the right and left of the mass little below the ureteral orifices. Free use of the solution in making this last injection should fully infiltrate the peri-prostatic plexus and render the enucleation quite painless. Kolischer and Eisenstaedt injected the periprostatic plexus through the perineum. This procedure I have not followed as a decision to do a one-stage prostatectomy was seldom made until after the bladder had been opened. Moreover, it would seem that as nearly perfect anaesthesia as could be desired may be had by injections from within the bladder.

Enucleation of the growth may be done by open dissection under complete observation or by the more commonly used method of finger dissection.

CONTROL OF HEMORRHAGE

In the first of this group, hemorrhage was controlled by the use of a Hagner bag or gauze pack. It was a very noticeable fact that hemorrhage was slight as compared to the cases in which general anaesthesia was used, and the situation seemed ideal for the use of Lower's method of suturing the vesical orifice about an inlying catheter. The results by Lower's method in these few cases have been very gratifying.

Complete closure of the bladder following prostatectomy as

suggested by Lower, was not done in any of these cases, but smaller suprapubic drains than those commonly used, were found adequate.

RESULTS

Of the cases operated there were six one-stage prostatectomies and three two-stage operations. In six the Lower technique of control of hemorrhage was used, but in no case was the bladder closed entirely.

After-treatment in this group did not differ materially from that routinely employed, i.e., suprapubic drainage for several days following prostatectomy, or until the urine became clear then drainage by indwelling catheter until the suprapubic wound healed.

Convalescence did not differ from the ordinary. One case was healed on the sixteenth day and another healed and dismissed on the 18th day. The others required three or four weeks.

One death from uremia occurred on the third day after operation. This man seemed a good risk, having been drained by catheter for fifteen days, and showed a phthalein output of 55 per cent. At autopsy both kidneys were found to be so completely studded with small cysts that polycystic disease was the first impression. Histological study demonstrated the condition to be cystic degeneration of interstitial nephritis.

The ages varied from fifty-five to eighty-six years. Several had serious cardiac disease. One had pronounced coronary disease with frequent attacks of dyspnea. Another, eighty-six years old, had cardiac hypertrophy, chronic aortic fibrosis, with probable atheroma, myocarditis and general arteriosclerosis, with blood pressure varying from 246/98 to 160/56. On admission to the hospital he was in uremic coma. The bladder was greatly distended, catheterization was impossible, and it was necessary to resort to suprapubic trocar puncture. Through the cannula a catheter was passed and drainage was thus maintained for six weeks. Though much relieved by relief from urinary toxemia general anesthesia was distinctly contraindicated. An unusually large growth was removed in his case under local anesthesia, and he is convalescing satisfactorily.

CONCLUSIONS

From my experience with this small group of cases I have been impressed that local anaesthesia has a place in the field of prostatic surgery, particularly in cases of low blood pressure, cardiac and respiratory disease, and marked renal impairment.

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PERINEAL PROSTATECTOMY UNDER SACRAL ANESTHESIA

A REPORT OF 176 CONSECUTIVE CASES

EDWIN DAVIS

In determining what the operation of prostatectomy has to offer for the patient, we are interested in the following two considerations: (1) What is the immediate mortality of this operation? (2) What are the late functional results? Without going into technical details, it is my purpose to briefly present two charts summarizing the immediate and the late results in a series of cases of perineal prostatectomy under sacral anesthesia.

IMMEDIATE RESULTS

Chart I tabulates the immediate results in 176 consecutive cases in which sacral block anesthesia was employed. Each received a preliminary hypodermic of morphine, ¼ grain, followed by a (caudal) injection through the sacral hiatus of approximately 40 cc. of 1 per cent novocaine, supplemented by the injection of approximately 10, 8, and 5 cc. of the same solution into the first, second, and third sacral foramen upon either side. It is to be noted that the average age of these patients was seventy and that there were 16 of them past eighty, two of them being eighty-eight. Although there were three deaths in the entire series, there was a total consecutive series of 121 cases with no deaths. In the one case of rectal injury, urethro-rectal fistula was prevented by suprapubic drainage. It is to be noted that so-called post-operative "shock" was conspicuous by its absence, this fact being due to the local anesthesia and to the careful and deliberate control of hemorrhage and also, in my opinion, in no small measure, to the employment of the perineal rather than the suprapubic route of approach.

It may be stated without exaggeration that the sacral block method affords an almost ideal form of anesthesia for perineal prostatectomy. When one is familiar with the technique, the complete sacral block injection may be carried out with comparative ease in about ten minutes' time. The risk is negligible, in that there has not been an anesthesia death during the entire series; neither has there been a reaction of consequence. Although slight reactions, characterized by a moderate drop in blood pressure and by more or less pallor and perspiration, and more rarely by nausea and mild delirium, are not uncommon, there has not been a single instance in which the reaction was in any measure alarming. The chief objection to this method in the hands of different observers, has been the rather small percentage of cases in which there has been inexplicable failure to produce satisfactory anesthesia. The figures here presented and those presented in a former paper published in 1924 are of interest in this connection and tend to throw some light upon the cause of this occasional failure. In this former paper (1) a series of 30 consecutive cases of perineal prostatectomy under sacral block anesthesia was reported. Among this series, 3 were complete failures and 4 required additional gas inhalation anesthesia during the final stages of enucleation. Thus 7 out of 30, or 23.3 per cent, were unsatisfactory for reasons not understood. In the present series, there has not been a single case requiring auxillary gas inhalation anesthesia during the last 50 consecutive cases, and out of the last 100 cases, gas has been necessary during the final stages of enucleation in three instances only. Thus the percentage of failure has been reduced from 23 to 3 per cent. Since in all instances the same drug in the same concentration has been employed, and since there has been no deliberate modification in the technique of injection, the only logical conclusion is that through practice, the anesthetist has learned to place the needle more accurately in the foramina. In other words, it is possible for the anesthetist to be mistaken in considering that the needle point has been properly placed within the caudal canal or in the foramina, and the percentage of failures may thus be adequately explained upon a technique basis without

recourse to the various anatomical and physiological theories which have been advanced.

As noted above, hemostasis has been an important factor in maintaining a minimum mortality rate. The ideal complete hemostasis may be approached by (1) the opportunity for deliberateness in controlling individual bleeding points by suture and ligature as permitted by time afforded by the sacral anesthesia, and (2) by the use of the perineal hemostatic bag described in a previous publication (2).

Proper preliminary drainage, the most important factor of all in reducing the mortality rate, has been dwelt upon in many

TABLE 1

Perineal prostatectomy under sacral anesthesia

Immediate results

Total consecutive cases	176
Average age	70
Above eighty	16
Deaths	3
Total consecutive cases with no deaths	121
Sacral anesthesia (number of failures last 50 cases)	0
Rectal injury	1
Post-operative "shock"	0
Delayed hemorrhage (several days)	5
Epididymitis	23

publications in recent years by competent authorities, and is too well recognized to require a discussion at this time.

It may therefore be stated that the above factors (preliminary preparation, sacral anesthesia and complete hemostasis) have resulted in reducing the mortality of prostatectomy to almost nil. In fact, it may be said without exaggeration that the problem of the immediate mortality of prostatectomy may be considered to be satisfactorily solved with one reservation only. I refer to *delayed hemorrhage*. As may be noted in table 1, this complication has occurred in five cases out of 176. Sudden, profuse hemorrhage, occurring as late as the tenth post-operative day, and interrupting an otherwise smooth convalescence, is a menace which may be neither foreseen nor prevented, and which occurs

probably as the result of infection and slough, and constitutes a grave emergency, in that its seriousness may not be recognized until the patient has gone into collapse. Hemorrhage of this character is a complication which should not be temporized with and which calls for immediate re-introduction of a bag or pack. In three of the above cases, an immediate suprapubic

TABLE 2

Perineal prostatectomy under sacral anesthesia

Late results

Total consecutive cases questioned		100
Time elapsed since operation		3 to 24 months
Patient's *own* opinion	Well	81
	Improved	15
	Unimproved	4
Incontinence	Complete	0
	Inconvenient	2
	Slight	2
Nocturia	Not at all or once	43
	Once or twice	21
	Two or three times	25
	Four or more	11
Urinary fistula	Complete	1
	Slight	4
Recto-Urethral fistula	Immediate	0
	Late	1
Retention		1
Subsequent deaths		8

incision was made under local anesthesia in order to permit evacuation of clots and the introduction of a Hagner bag. Hemorrhage of this character was indirectly responsible for one of the three deaths in that the patient's resistance was lowered by loss of blood to such an extent that gangrenous infection of the incision set in, resulting in general sepsis and death ten days later. Of the other two deaths, one was considered to be due to embolus, and the other to renal insufficiency.

LATE RESULTS

Chart II summarizes the late functional results as determined by questionnaire blanks returned from the last 100 consecutive cases. In order to avoid complications and misunderstandings, only the following simple, direct questions were asked.

1. Is the wound entirely healed?
2. Can you control the urine?
3. Do you pass urine too often?
4. How many times do you get up at night to urinate?
5. Does the urine pass without difficulty?
6. As far as the operation is concerned, do you consider yourself (1) well, (2) improved, or (3) unimproved?

The last question, number six, was considered to be the most important and was for the purpose of obtaining the patient's *own* opinion as to the result of the operation.

As shown in table 2, 81 of these patients unequivocally stated that they considered themselves well, while there were 15 improved and 4 unimproved. An analysis of this data indicated that the majority of those in the improved group did not consider themselves well on account of varying degrees of frequency. In this connection it is to be noted that in a series such as this, there would necessarily be a fair percentage of cases of advanced pyelonephritis and other chronic infections such as to prevent all possibility of the return of the urinary tract to normal.

The question of post-prostatectomy incontinence is a subject deserving careful consideration. Although there was no case of complete incontinence, there were two with a sufficient degree of incontinence to be a cause of considerable inconvenience. While each of these patients has intervals of complete dryness and has the ability to start and stop the urinary stream at will several times while voiding, there is a weakness of the external sphincter, as indicated by leakage, at intervals, of small amounts on any undue exertion, such as coughing or sneezing or suddenly rising. Since these patients have intervals of complete dryness, and since they have the ability voluntarily to start and stop the urinary stream, it is evident that a sphincteric structure exists and it is therefore logical to consider the possibility of individual anatomic variation in the musculature or innervation of the

external sphincter. I have under observation at the present time a patient with this identical type of sphincter weakness following suprapubic prostatectomy. In this connection, I do not intend to minimize the possibility of external sphincter injury by the perineal operation. It is to be frankly stated that this is a very real danger, particularly in those cases in which the internal sphincter has been rendered functionless by the gland itself. In addition to these two, there were two others with slight degrees of incontinence. It is likely that in at least some of these four cases the unsatisfactory control resulted from technical error at operation.

The question of post-prostatectomy urinary frequency is likewise shown in table 2. Sixty per cent of these patients find it necessary to pass urine during the night not more than once or twice. Some of these, although having a greater degree of frequency than this, were willing to consider themselves well on account of the relief from obstructive symptoms.

The one case of complete urinary fistula resulted from the formation of a fibrous structure or septum at the apex of the prostate. Since this condition has subsequently been restored to normal by an intra-urethral operation, this fistula no longer exists. The four patients with slight perineal urinary leakage each complained of the escape of a few drops of urine at intervals through the perineum at the time of voiding. In each case, this condition existed over a period of several months. Two of these have been subsequently cured by a secondary minor plastic operation. The other two have been lost sight of.

There has been no case of immediate post-operative urethro-rectal fistula. One patient, in a very debilitated and weakened condition, had a long, protracted convalescence associated with perineal pain and an elevated temperature over a period of three or four weeks. Five weeks after operation, he developed a leakage of urine into the rectum, this fistula having occurred presumably as a result of a periprostatic abscess.

In the one case of post-prostatectomy retention, this was found at autopsy to be due to an unsuspected vesical carcinoma, occurring in the region of the prostatic orifice.

CONCLUSIONS

1. Present day methods (preliminary preparation, sacral anesthesia and hemostasis) are such that prostatectomy has come to be a benign procedure with a mortality rate that is almost nil.

2. Assuming proper attention to the above details, the chief hazard of prostatectomy is that of sudden, profuse and exsanguinating secondary hemorrhage occurring as late as the tenth day. This hemorrhage should be treated as an emergency measure and should be checked by mechanical means even though a secondary operation may be necessary. Under these circumstances, it is an error to wait and hope that this hemorrhage will cease.

3. As far as the late functional results are concerned, it is conservative to expect 80 per cent of satisfied patients and 15 per cent of fairly satisfied patients.

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MYOSITIS OSSIFICANS FOLLOWING SUPRAPUBIC PROSTATECTOMY

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Myositis ossificans as a clinical entity has been recognized for many years. The present keen interest in this subject began with the perfection of and the routine use of the roentgen rays. The history of injury that precedes many of these cases gives them a medico-legal aspect, and this feature also heightens the importance of a thorough study of each case.

In this paper I shall present another phase of this subject, namely, the occurrence of myositis ossificans after clean-incised wounds. It has been known for some time that myositis ossificans may follow surgical operations. Cases have been reported in which this condition followed operations upon the stomach. According to Gruca, cases belonging to this category have been reported by Roepke, Sabjinka, Capelle, Wollenberg, Nierenberg, Rokintauski, Strassberg, Rixford, Clairmont and others. He further states that it was noted by Jones after a herniotomy, after puncture wounds by Bender and Werner, and after incised wounds of the thigh by Cramwell and of the glutei by Schwarz.

Although upwards of 500 articles have been published on this subject, the occurrence and publication of cases of this condition following suprapubic prostatectomy are exceedingly rare. As a matter of fact the only case I was able to find which was similar to the one I shall report was the case published by Lewis. Of interest in this connection may be the case reported by Billroth in 1855, in which the author reported an autopsy in which he found partial ossification of the tendon of the adductor muscle in an elderly, retired cavalry officer who died from the effects of severe hypertrophy of the prostate. Probably no causal relationship existed.

The various theories which have been advanced in explanation of this condition have been reviewed so often in recent years that they will not be taken up here again. Those interested in this phase of the subject will find the publications of Carey, Fay, and Gruca serviceable.

My only reason for presenting this case is its extreme rarity.

CASE REPORT

Mr. H. B. H., aged sixty. About three weeks ago the patient was operated upon and a suprapubic prostatectomy was done in another hospital.

I was asked to see the patient because of the persistence of a suprapubic fistula and chills and fever that had been present every day for the past five or six days. I was asked to do cystoscopy to determine the cause of the persistence of the fistula. His physician stated it was impossible to pass a cystoscope, but that a catheter could easily be introduced into the bladder. Because of the recent attack of chills and fever I advised non-interference and expectant treatment only. In my opinion it was far better to delay an exploration of the wound and bladder for a week or ten days than to interfere at once.

Operation. March 9, 1926. The suprapubic fistula was dissected out. It was very hard and thick. On each side of the fistulous tract in the rectus muscle was an area of extreme hardness which upon palpation and inspection had the appearance of bone formation. These areas were removed. Bladder neck was tight. With the Caulk punch a median bar excision was made. Bladder neck was further divulsed with my finger and a small adenomatous nodule was removed with the finger.

The patient had an uneventful convalescence, and five days later an indwelling cathether was inserted into his urethra. His further convalescence was without note.

Histological report. Sections made from the median bar showed glandular hyperplasia. The masses removed from the rectus muscle were each about the size of a bean. These masses consisted of the rectus muscle, in the center of which was felt a hard nodule. Inspection showed the presence of a structure that looked and felt like bone.

Histological diagnosis. These specimens were sent to the laboratory of Surgical Pathology of Rush Medical College and examined by Dr. Oberhelman who verified the clinical diagnosis of myositis ossificans.

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DISCUSSION

Dr. Author H. Crosbie (Boston): I would like to say just a word about prostatectomy under local anesthesia. I have used it several times and it is surprisingly easy. This last winter I had two old men with low blood pressure—one of ninety-two and one of eighty-seven—that I did not like to use a general anesthesia on. Both of them had been drained suprapubically. I merely infiltrated around the bladder incision; with the left forefinger in the bladder, I took a long Labat needle and infiltrated the whole prostatic area and then enucleated the prostate. It was very easy in both cases and caused very little pain and there was surprisingly little bleeding afterward.

Dr. Benjamin S. Barringer (New York): I think Dr. Hamer has brought up an operation which a good many of us apparently have more or less put in the discard or forgotten or never tried. I think his method of anesthesia is probably more perfect than any that I have either read about or heard of.

Some years ago I did twelve consecutive prostatectomies under local anesthesia. In a certain number of those cases I infiltrated through the perineum, and I think you can get a very excellent infiltration of the prostatic sheath in this way. I think the majority of cases in my hands had considerable pain, especially those cases where you had to pull and tug at the prostate to get it out, as occurs once in a while, I could not devise any method of infiltration-anesthesia which overcame this. On the other hand, there was a patient, a doctor, that I did this operation on because he rather requested it and I carefully questioned him afterward about the pain and he said the most painful part was the original sticking the needle in the skin. That was pretty good. I think that was probably the best of all of them.

I think Dr. Davis' presentation and results are very impressive.

Dr. HENRY H. MORTON (Brooklyn): I think Dr. McCarthy's plan of making a transverse incision in the wall is the ideal method of opening the bladder.

For the past three years I have been using this method which was suggested by Voelcker originally.

It has the great advantages, first, of not opening up the space lying behind the pubes and permitting a pool of urine to seep in and lie there, and secondly, of giving an excellent view of the interior of the bladder, and third, the line of suture in the bladder is more accessible.

After the bladder is exposed, light transverse incisions are made through the serous membrane covering the bladder until the muscular coat of the bladder is exposed. It is then an easy matter to push the peritoneal fold upward, leaving the lower part of the bladder and space behind the pubes unopened, and protected by its natural covering of serous membrane.

Retaining its natural covering of serous membrane in situ, is a perfect protection against urine leaking down and filling the space behind the pubes, which is so apt to occur when the serous membrane and peritoneal fold are pushed upward together as is ordinarily done, with a gauze sponge.

After the bladder wall is exposed and the peritoneum pushed upwards, the bladder is opened by a transverse incision instead of the usual longitudinal cut.

One advantage of the transverse incision in the bladder is that we are able to get an excellent exposure of its interior and another advantage is that when the bladder wall is sutured, the line of suture is directly in the center of the wound and both extremities can be easily sewed, while with the ordinary longitudinal incision, the lower sutures must be introduced into the lower angle which is concealed by the pubes and the upper angle lies dangerously close to the peritoneal fold.

Dr. ARTHUR L. CHUTE (Boston): Strange as it may seem, I am not going to discuss anesthesia. I do want, however, to speak about the sewing of the bladder outlet. Some of my prostatectomy cases have now gone a long time since they were operated

upon and I am beginning to see an occasional one that apparently has a bit of obstruction at the bladder outlet. There have been relatively few but they serve to make me think that we are going to have some of those patients that live a long time return with a certain amount of obstruction. I believe that this is due to a fibrous condition, a contraction of the edge of the capsule from which we have enucleated the gland.

I think we want to be very careful how we plunge into any procedure to constrict the bladder outlet operatively for the reason that I believe, as time goes on, there is going to be an increasing number of those tight outlets which will occur, due to what I suppose is fibrous contraction. They have not carcinoma, as far as I can make out; nor a fibroadenomatous growth, but a tight bladder outlet. It seems to us that it is better to leave the bladder outlet as funnel-shaped as we can. I have no definite statistics but I think it is something to be considered.

Dr. Hugh H. Young (Baltimore): These papers are of very great importance, but for lack of time I will confine myself to Dr. Davis' paper, which has interested me very much. Through Dr. Davis I became interested in the use of sacral anesthesia in prostatic surgery. I soon found that caudal anesthesia was sufficient in the large majority of cases, and that it was unnecessary to make the lateral injections into the nerves as they emerged from the canals in the sacrum in order to obtain excellent anesthesia for perineal prostatectomy, and also for such extensive operations as my radical operation for carcinoma of the prostate and for tuberculosis of the seminal tract. Where a single injection is made into the sacral canal, the procedure is very simple, but if one carries out also the lateral injections of the nerves, the procedure is, in my opinion, made a good deal more complex, and more of the anesthetic is required, so that is is not only more difficult, but, I believe, distinctly less safe. As epidural caudal anesthesia is sufficient and entirely satisfactory in about 94 per cent of the cases, we have used this to the exclusion of almost all other methods for the past three years. At first we employed 50 cc. of a 1 per cent solution, and had a good many cases in

which there was rapid and a pronounced drop in blood pressure. Then, at my suggestion, Shaw carried out research on cadavers with epidural caudal injections of methylene blue, and showed that when 50 cc. was introduced, the dye penetrated often to the cervical region. With 30 cc. the dye reached into the dorsal region, and with 20 cc., generally well into the lumbar. It seemed evident, therefore, that smaller amounts of more concentrated solution would be preferable, and we, therefore, at his suggestion, began using a 20 cc. of 3 per cent solution which was injected epidurally through the sacral canal and have found this very satisfactory. In a recent report made by Berry[1] a careful analysis of a long series of our cases has been presented. With this technique not only is an excellent anesthesia obtained, but also a splendid relaxation of the muscles of the perineum and ischiorectal region which greatly aids in prostatic operations. There is almost always a drop in blood pressure, generally of no moment, and with the advantage that there is less oozing and a clearer operative field. In some cases one does see a very pronounced drop in blood pressure, and it is advisable, on this account, to have on hand adrenalin, with syringes for either intramuscular or intravenous injections, in order to combat a pronounced rapid fall in blood pressure. Four or 5 mgm. introduced intramuscularly is usually sufficient to combat the fall in pressure. If the drop is very marked, and rapid, the intravenous injection of 1 mgm. is usually sufficient to combat the situation, although it may be necessary to repeat it. The use of caudal anesthesia is of great advantage, particularly in cases with pulmonary and renal lesions. The fact that in from 5 to 8 per cent of the cases it may be necessary to use a small amount of nitrous oxide, is not, in my opinion, sufficient to condemn the method.

Dr. Davis has referred to hemorrhage, and it gives me pleasure to testify to the efficacy of his hemastatic bag with which it is possible to do away completely with the gauze packing that we employed for so many years. The modification of Pilcher's modification of Hagner's original prostatic bag is a very simple

[1] Berry, G. P.: Caudal epidural anesthesia in perineal surgery of the genitourinary tract. Jour. Amer. Med. Assoc., 1928, xc, 1018–1021.

means of providing drainage, and at the same time combating hemorrhage. It is quite remarkable that by traction upon the cotton tapes the hemorrhage not only at the prostatic orifice, but from the prostatic capsule and outside of it, is completely taken care of so that it is never necessary to use gauze packing. One slight objection to the bag is that the healing of the fistula takes longer than when median drainage of the bladder with lateral packing of the cavities with gauze was employed in our clinic. In a good many instances, various members of my staff have used along with the Davis bag, a catheter in the urethra, which was inserted at operation and kept in place after the Davis bag was removed during the first twenty-four hours after the operation. By means of this technique the closure of the perineal fistula is much hastened, but on the other hand, the percentage of epididymitis is larger than when the urethral catheter was employed.

The frequency of epididymitis has led various operators to use vas ligation as a preventive. In our clinic it has been used at operation, and now in many cases immediately on entrance into the hospital, as soon as it is determined that prostatectomy is to be carried out. Colston has presented a very simple technique by which the vas is isolated and ligated by thrusting a needle beneath it without making an incision in the skin. Alyea has advocated the immediate ligation of the vas before cystoscopy or catheterization of the bladder is carried out, and has shown that it is possible to greatly reduce the incidence of epididymitis. During the past year we have experimented considerably with complete closure of the prostatic wound through the perineum and urethral catheter drainage. It is quite easy to completely stop hemorrhage and close the prostatic capsule, as shown in our recent paper.[2] A study of about 100 cases in which we have employed this method shows that per priman healing (with no leakage of urine through the perineum) has been obtained in about 60 per cent of the cases. Further analysis, however, shows more trouble with infection, and I am now uncertain as to whether the method

[2] Young, H. H.: Some problems in cases of prostatic hypertrophy. South. Med. Jour., 1928, (in press).

of plastic closure should be recommended for general adoption or not. Infection and embolism still remain the most serious problems in the convalescence after prostatectomy, both perineal and suprapubic. By the use of antiseptics before, during and after operation, and intravenous therapy, much has been accomplished in combating infection, both local and general.

Dr. Davis' report of 121 cases, in which he carried out perineal prostatectomy without a death, is a splendid accomplishment. I am delighted to see that the Society is now much more tolerant than it was some years ago (1908) when I made a similar presentation in a paper entitled "Remarks on a fatal case after 128 consecutive successful cases of perineal prostatectomy," and attempted to draw conclusions as to how this death should have been prevented. When I sat down one of our most distinguished members, Dr. Keyes, got up and said, "I too, had one death following prostatectomy," and sat down. He was followed by Dr. Hugh Cabot who said, "I, too, have had a death after prostatectomy," and he in turn by Dr. Frank Hagner and others, all of whom made this simple, direct statement, and then took their seats. I am frank to admit that I was terribly upset, and had concluded that I would never speak to them again, when I found that the whole thing had been concocted on the sleeping car the night before. I am glad to see that now, however, Dr. Davis' splendid series of cases is accepted as not so unusual when the perineal route is employed.

Dr. VERNE C. HUNT (Rochester, Minn.): I think that all of us are striving to control hemorrhage from the prostatic capsule. Lower's modification or the Lower method of closing the prostatic capsule possesses its greatest advantage in control of bleeding. The various methods we have at hand, the pack, tampon and bags, have served very well for the control of immediate operative bleeding but I think we all have experienced some trouble when these foreign bodies have been removed from the prostatic capsule. The method we all desire to use is one which completely controls operative bleeding and obviates the occurrence of postoperative bleeding. I speak of this because postoperative bleeding is most important in the light of infection.

In the last few months I have reviewed 100 deaths that have occurred in the clinic, 98 of which we have had autopsies on, and the interesting thing is that the death was due, in 57 per cent of the patients, to infection, that is infection localized in the urinary tract or a generalized infection. I might say that 37 per cent of the cases were due to acute pyelonephritis. Practically all patients who have residual urine and renal insufficiency may be satisfactorily prepared before operation and made a comparatively safe risk. However, we know that when there is postoperative bleeding it immediately reduces their resistance to infection and I think we can say in many cases that infection has been the direct result of the lowered resistance through continuous bleeding postoperatively, even though small in amount. So I think it is a most important thing that we control the bleeding postoperatively.

I think Dr. Young brought out a very interesting point regarding the incidence of pulmonary embolism. I fully agree with Dr. Young that a good many of these are due to infection. I think that has been quite definitely proven. Since we have adopted as a routine procedure the preoperative preparation of all patients, the incidence pulmonary embolism has been markedly reduced. However, it does occur still and I think Dr. Young's point is a very good one. The more suturing that is done at the bladder neck and in the prostatic capsule the greater must be the incidence of prostatic hemorrhage through the introduction of infection in the prostatic plexus.

I also want to congratulate Dr. Davis on his excellent report. I think it is one we all wish to strive to duplicate.

Dr. NATHANIEL P. RATHBUN (Brooklyn): It seems to me that the operation described by Dr. McCarthy, and practiced by Drs. Hunt and Lower, is certainly far more of a surgical procedure than the one we commonly use. My feeling has always been that in the hands of the average operator the one thing that has done more than any other single thing has been the preliminary drainage. I have practiced the method outlined by Dr. Chetwood with much the same happy results. I think there is little danger of

hemorrhage if the pack is removed gradually after three or four days.

I would be interested in having Dr. McCarthy tell us if his period of stay in the hospital has been shortened by his present method of operating.

There is one other point, on the question of anesthesia. I am using sacral and para-sacral anesthesia and have used it in something over one hundred cases with only two failures. Next to the matter of drainage, that is second in importance to my mind.

Dr. FRANCIS R. HAGNER (Washington): I feel rather pleased that so much importance has been given to hemorrhage in prostatectomy. You will remember that about fifteen or twenty years ago when I first showed this bag a number of men said they would keep it on hand and they would use it in cases if necessary, and I told some of them not to keep it too long because rubber did not keep indefinitely. At that time everyone seemed to be skeptical about the importance of controlling hemorrhage. I felt it was most important and everybody seems to be coming around to this point of view.

I was unfortunate in being delayed and in not hearing these papers. I have been very much interested in pulmonary embolism. We have lost cases from pulmonary embolism and I imagine infection has a good deal to do with it. In all of our cases but one the patients were practically ready to go home when they died. It did not occur early after the operation. One of our patients had three attacks and finally the third one got him.

It has been my experience in prostatectomy that in the last year or two I have had the worst cases I have ever had and I believe the reason is that a good many men send the bad cases to some fellow who makes more or less of a specialty of it. Dr. Fuller mentioned the other day that we have had the worst group of cases to operate on that he had ever seen. For instance, we had a man the other day who had attacks of angina pectoris. He was terribly ill when he came to us. We drained him for about three weeks with an indwelling catheter. He improved greatly

and we had him down in the operating room ready to do a prostatectomy. I looked at him and he did not just look right. I spoke to him and asked him how he was feeling and he said he felt all right but he had a slight tingling in his arm. I looked him over and found that his blood pressure was about 185 to 190. It had been 165. I said, "I think we will send you back to the ward; we will not do you today." We sent him back and he was better the next day. The next morning the nurse was giving him a sponge bath and turned him over, when death occurred. We were surely fortunate in not operating on him.

Dr. J. Bentley Squier (New York): Mr. President, and Gentlemen: I would like to say a word in regard to Dr. Kretschmer's report of his case of Myositis Ossificans.

About four years ago I did an ordinary prostatectomy on a gentleman who had, as he suggested in his case, a slow-healing sinus. He came back about six months after operation and he was put through the x-ray to see if by any chance there was some foreign body in the bladder. No foreign body was found in the bladder, but a ring of calculi or calculus degeneration was found in the rectus muscle itself and it was quite apparent because stereoscopically it showed at a very superficial level. The sinus was curetted out and healed. The gentleman is alive with a perfect result today but an x-ray picture at any time will show those calcifications which are very distinct in his rectus muscle.

I was afraid at first that you were going to report that something had happened to this patient of mine since I saw him, but I have seen him in the last six months and I think your report antedates that.

I went over a thousand cases to find how often death from embolism occurred and I found that it occurred in about the same percentage of cases fifteen years ago as it does today, which means it will run from two to three cases a hundred irrespective of what type of operation has been done, perineal or suprapubic, or whether an attempt has been made to suture the capsule or with wide open drainage.

I agree with Dr. Hagner that the post-operative hemorrhage

which seems to be most disagreeable occurs very frequently rather late in the post-operative period, five or six days afterwards or possibly a week. I often wonder whether methods used at the time of operation for prevention of hemorrhage have very much effect upon the late post-operative hemorrhage.

Dr. J. R. McCarthy (closing): Our experience has been the same as that of Dr. Morton in regard to the advantages of the transverse incision in the bladder and the ease of repair.

Perivesical infiltration and infection has been very greatly diminished in our hands since the advent of adequate suction drainage. I think the advantages of this method have not been sufficiently stressed, although a number of the gentlemen here make routine use of it.

I can confidently recommend the installation of this system in your wards or private rooms. I believe Dr. Squier is using it at the new Medical Center.

Dr. Squier: Yes, I have it in every bed.

Dr. McCarthy: It is the most satisfactory thing that we had ever had done for us. In so far as the suture of the bladder outlet producing stenosis is concerned, we have been very careful, as I know Dr. Hunt has been, to merely obtain adequate approximation of the torn parts. It does seem to me that adequate approximation with irrigation and suction drainage, will result in less scar tissue formation than spontaneous cicatrization.

Dr. Young's comment on the time lost—that is a matter for decision as to the patient's condition at the time of operation. With spinal anesthesia, which we employ as routine, we find that time is much less a factor and that the adequate repair of these parts with the minimum hemorrhage post-operatively is more than compensation for the added time.

As to Dr. Rathbun's discussion, we, of course, prefer the one-stage operation, which is in reality a two-step operation. Adequate drainage, of course, is a preliminary requisite. When we supplement that with the present-day blood chemistry, we have a fairly good live insurance policy on these patients.

As to stay in hospital, prior to suction drainage, prior to our present methods, the stay in the hospital of a patient was anywhere from ten days to eight weeks. Since doing this operation, our results have been, in the best cases, six and seven days and our longest cases three weeks, with an average of about two weeks. I think that more than compensates us for the methods suggested.

Our position with reference to the hemostatic bags is that the fewer the apparatus introduced into the prostatic cavity, the better for the patient. I cannot escape the feeling that the presence of these bags under pressure in a bleeding cavity predisposes to infection and possible embolism. A traumatic urethritis automatically follows. We feel that surgical repair should obtain here as it does in every other operation.

Dr. EDWIN DAVIS (closing): Dr. Young has raised the question concerning the relative value of the simple caudal injection and the complete sacral block. I do not believe that Dr. Young quite realizes how simple this complete sacral block is, when it is done as a routine, and I feel that surely the percentage of cases requiring general anesthesia is much less with this method. Our figures show this.

With respect to delayed hemorrhage, I was hoping that I might get some information on this subject. I wish after this meeting someone would confidentially tell me how to foresee and prevent and control this ten-day post-prostatectomy hemorrhage.

PHASES OF THE PATHOLOGY, DIAGNOSIS AND TREATMENT OF CARCINOMA OF THE PROSTATE

BENJAMIN S. BARRINGER

From the Urological Service, Memorial Hospital, New York

Most prostatic carcinomata have origin in the posterior lobe. This lobe, were it not for this fact, would remain insignificant and almost unknown. It does not hypertrophy as do the other prostatic lobes. It lies between the prostatic urethra and the rectum, and this position makes it the most accessible of all the lobes of the prostate to palpate by a finger introduced into the rectum. It is perhaps 0.5 cm. in thickness, and lies between two strong constricting fasciae.

When a cancer starts in this lobe there is no open space in which the cancer may grow, and growth takes place in a course directed by these fasciae. That course is almost never outward toward the perineum, but upward further into the body cavity, along the posterior pelvic chain of lymphatics, and therefore still more inaccessible.

These constricting fasciae are often stretched by the growth, but while the fascia on the bladder side is frequently penetrated by the cancer, that on the rectal side almost never. So we have the phenomenon of a semi-internal cancer beginning in a semi-inaccessible place, with little or no symptoms, growing in a position where it cannot be seen, but where it can be felt, early growing beyond the prostate, and becoming still more difficult to reach. In 98 per cent of our cases, when first seen at the Memorial Hospital, the cancer had grown beyond the prostate.

These are briefly the factors which make the diagnosis and

treatment of prostatic cancers difficult. Until recently[1] specimens for pathological examination were only obtained after a surgical operation for the removal of the cancerous prostate. So we have but slowly come to recognize the great variations in the degree of malignancy of different prostatic cancers, and therefore variations in their growth rate.

It is probable that the most malignant types invade the lymphatics early, and spread rapidly through the lymphatic chains. I have seen one such case with a prostatic cancer so small as to be barely recognizable, yet with extensive lymphatic involvement, and with a large cancerous signal node, many times larger than the primary cancer, in the left supra-clavicular space. At the other end of the chain is the prostate of low grade malignancy. We have autopsied a patient with a very large prostatic cancer, almost filling the pelvis, yet with no lymphatic invasion beyond. Bumpus has also called attention to these growth variations.

The most malignant cancers classified according to Broders and corresponding to Dr. Ewing's grade 3 are, because of their cellular and undifferentiated structure, what is called "radio-sensitive." That is, they are much more affected by radiation than the less malignant sclerotic types, and therefore more susceptible to control. These, the radio-sensitive group, comprise but perhaps 5 or 10 per cent of all prostatic cancers.

We are at the present time attempting to classify clinical data which would help in identifying the radio-sensitive carcinoma. It has been suggested that only the most malignant types break through the bladder base or prostatic urethra and directly invade the bladder. This point can be easily determined.

We believe it is of a great deal of importance to identify these various grades of malignancy for this reason: If a prostatic cancer is highly malignant, and is sufficiently limited in its extent so that there would seem to be a hope of controlling the cancer, then

[1] We have developed at Memorial Hospital a specimen taking needle which may be inserted through the perineum into the prostate, and guided by a finger in the rectum. We have been able to get a specimen for examination in 2 out of 3 cases.

operation is the last thing to be thought of, and radiation the first.

The trauma caused by an attempt to remove a cancerous prostate, either by the perineal or suprapubic route, cannot but help as far as I can visualize, to squeeze cancer cells into lymphatics, and so spread the disease. We have seen not a few patients who had been subjected to a suprapubic prostatectomy in whom the cancer subsequently grew through the suprapubic wound.

A prostatic cancer, unless interfered with by operation rarely grows in this direction. This applies not only to the most malignant group, but to all prostatic cancers. Radiation should be employed before any contemplated operation to devitalize the cancer cells.

We have intimated that specimens for pathological examination are difficult to get from a prostate, so we make the diagnosis of radio-sensitivity by reversing the procedure. The patient gets x-ray treatment first, and the diagnosis of radio-sensitivity is made by observing the effect upon the prostate. Deep x-ray treatment should be reinforced by radium needles, inserted through the perineum into the prostate.

This applies naturally to those prostatic carcinoma, which from our examination we believe are small enough to control.

In our first series of 42 cases we controlled 5 or 10 per cent for more than five years, and these 5 presented no signs or symptoms of cancer. In the next series we did not do as well. Now we are swinging back to our 10 per cent by better methods of diagnosis and treatment.

This radio-sensitivity of prostatic cancers is the reason why we can prolong life in some extensive cancers, which, when first seen, are far beyond control. I have recently seen 2 cases of this group. One had metastases in nearly every bone in his body. In both patients, radiation caused marked changes in the primary and metastatic tumors, and prolonged the patients' lives, as far as I could judge, one and three years respectively.

From the standpoint of diagnosis of prostatic cancer, we have come across one point of interest. We know that of all prostatic hypertrophies, perhaps 20 per cent are cancerous—that

the differential diagnosis between simple hypertrophy and cancer is often difficult, and more often not made before operation.

We have, in the course of a piece of research on the effect of deep x-ray therapy on hypertrophied prostates, made the diagnosis in three different cases of what seemed to be simple prostatic hypertrophy. A few weeks after a course of deep x-ray, this diagnosis was changed to that of cancer. The prostate which formerly felt soft and regular had changed to one hard and irregular. The only way we could explain this was that a certain amount of edema had masked the underlying cancer, and the x-ray treatment had removed this edema. We believe that if this is a constant result, it may prove of considerable value in making this differential diagnosis.

While we do not entirely agree with the opinion expressed by a well-known surgeon that "Whatever one does for a patient with a prostatic cancer, one does the wrong thing" we do believe that this, in a way, voices the difficulties of treatment. Suffice it to say, that at present—as far as our own experience goes—the following not too rigid rules should be applied:

1. An attempt to control the prostatic cancer should be made in those cases in which we believe the cancer has not grown far beyond the prostate, and which show no bone metastases. In the hands of most surgeons, complete operative removal of a cancerous prostate rarely seems feasible or possible. When this is attempted, portions of the cancer are almost invariably left behind. In all due fairness, however, Dr. Young has recently reported 27 cases of prostatic carcinoma, in which he carried out his radical operation. Two of these patients are living and well after 13 years. Two are alive and well over 7 years, and over 70 per cent are alive and apparently well over 5 years after leaving the hospital. The diagnosis in most of Young's cases was made on clinical examination, and in a few sections were made after perineal exposure which confirmed the diagnosis, and the radical operation was then carried out. It is my opinion, however, that in most cases where a radical cure has been obtained, the lesion was very small and the diagnosis made from the pathological section. To my mind, radiation to control the cancer is superior to operation.

2. The problem of the control of cancer, and the urinary obstruction are two different ones, and should be dealt with separately—the one by radiation, and the other with minor operations.

3. Extensive major operations should as far as possible, be avoided, if we can have a substitution therapy as efficient as operation. The reason for this is that we can give no assurance of cure by any method; that if we fail to cure we have deprived the patient of from two to six months of his short remaining span of life, granting it takes from two to six months to recover from this major operation. We know that the large majority of patients will not live for two years after first seen. In 102 consecutive cases seen at the Memorial Hospital, but 15 lived over three years, 6 over four years, 5 over five years, and 3 over seven years.

4. In the control of symptoms, sciatic and various other nerve pains, and pressure edema of the legs, radiation may accomplish much, or may fail.

This ends my very brief summary of treatment. We are at present only at the threshold of knowledge, both as to the cause and the control of prostatic cancer. We must insist upon regular examination of the prostate in all persons over the age of sixty. Such examinations should be a part of the periodic examination of the heart, blood vessels, kidneys, etc. We must, above all, keep our minds open to new suggestions, new leads, change one thing here, and try another there. We should always be reluctant to place patients in the hopeless class. I vividly remember a patient who came to the Memorial Hospital so labelled. He had a large extensive carcinoma of his prostate, but his only symptom was severe pain in his left hip. A moderate amount of radiation entirely relieved his pain. He has remained reasonably well for three years, and today at the age of eighty still enjoys life.

If we progress, the seemingly hopeless case of today may become the promising one of tomorrow.

DISCUSSION

Dr. Arthur H. Crosbie (Boston): In spite of what Dr. Barringer says about operating on prostatic cancers, I consider the palliative perineal operation for an obstructed cancerous prostate as one of the most satisfactory operations that we have and I have had several cases that have gone, after such an operation, from five to eight years without any recurring obstruction and are well, so far as they know. In the years past I have worked with Dr. Chute and I have seen many of his cases go for a long period of time with complete relief from the obstruction. Of course, they still had a malignant disease there but I am perfectly sure that the palliative perineal operation did not hurry the growth of the carcinoma.

Dr. Hermon C. Bumpus (Rochester, Minnesota): I would like to confirm what Dr. Barringer said about the degree of malignancy determining the prognosis. Some time ago I reviewed our surgical cases of cancer of the prostate, dividing them into those cases in which the malignancy was discovered at operation and those in which the diagnosis was made prior to operation. Of the former 15 per cent (8 out of 51) lived more than three years, although the original growth was so obscure as to escape clinical detection. Of the latter but 12 per cent (8 out of 66) lived more than three years when the diagnosis was made prior to operation, although only the most favorable cases from the clinical standpoint were recommended for surgery. When grouped according to degree of malignancy, of 44 cases of lesser degrees of malignancy 16 lived over three years, while of 56 patients with higher degree of malignancy none lived over three years. Evidently the degree of malignancy more than its extent determines the prognosis.

Dr. Joseph F. McCarthy (New York): On this subject of radium, I feel it is due Dr. Barringer to relate one successful case I have had with carcinoma of the prostate.

We had a case come in with complete retention. It seemed on rectal examination, to be a case of carcinoma of the prostate. He was drained suprapubically for several weeks with so marked a recession of nodulation that we were not absolutely certain. Very foolishly I attempted, through the suprapubic incision, to enucleate it and found myself, very promptly, in a mass of cement substance.

I dug out some of this carcinomatous tissue, had it examined and it proved to be a carcinoma. Coming from the operating room I felt quite discouraged.

Later, radium seeds were implanted by means of the Pan endoscope, through the suprapubic incision, with the finger of the assistant in the rectum. This patient came into the hospital some two and one-half to three years ago. Today, much to my surprise, this patient has no residual urine; he is cystoscopically free. On rectal examination there is a fairly uniform dense fibrotic area. Clinically and symptomatically, this patient is apparently cured.

Dr. NATHANIEL P. RATHBUN (Brooklyn): I believe that most, if not all, cases live longer and live more comfortably if they have suprapubic cystostomy plus radium treatment. That applies, of course, particularly to cases having a high degree of retention or cases of irritability.

I have had one case, which Dr. Osgood also saw, of a man with a huge carcinoma of the prostate, almost complete obstruction. He had a cystotomy and was drained for a year. During that time he had three or four radium treatments. At the end of that time the prostate appeared normal and we closed the fistula. That was a year ago. He still empties his bladder completely and his prostate feels perfectly normal. I do not know how long that will last.

Dr. ALEXANDER RANDALL (Philadelphia): During the past winter I have observed a case which opened up quite a new field in diagnosis to me. A patient had been admitted to the medical service, having had a prostatectomy performed elsewhere some

few months before. He was evidently going down hill, carrying a large, infected residual and with other infections about his body, especially his teeth and tonsils, and the question came up as to whether this man was suffering from infection or malignancy.

The urologist at the other hospital reported the prostatic tissue he removed as benign hypertrophy. I made a rectal examination and found a big mass that suggested carcinoma though I felt that it might be inflammatory. The patient was sent down for an x-ray examination and we were all rather surprised to find the x-ray man coming out with a flatfooted statement: "The patient is suffering from carcinoma of the prostate." I went down and talked with Dr. Pancoast and his assistant, Dr. Pendergast, about these plates.

Finally I said to Dr. Pendergast, "If you saw these plates for the first time without clinical history, what would you say?"

He replied, "I would say that that man had carcinoma of the prostate or Paget's disease."

I said, "You mean nothing else matches that picture?"

He said, "Nothing."

A few days ago we were recounting the patient's demise and regretting the fact that we did not get an autopsy. I do not know whether all x-ray men are quite abreast of it—in fact, I know that some of them are not. The point is simply this: They feel on x-ray examination that they can pick out not only the usual osteoclastic destructive changes that are due to malignancy, nor yet the typical nodules of periostial metastasis, but a definite osteoblastic formation of new bone that is absolutely typical of prostatic carcinoma. They are not ready yet to say whether or not that this is a toxic result or whether it is due to embolic action in the medullary cavity of the bone, but there is a destruction of the bone medullary tissue, a destruction of the fine trabeculated bone medulla in these x-ray plates. It gives a most unusual x-ray picture.

In these plates, one would recognize right away that such was not a normal bone, but it is awfully hard to be able to say exactly what is wrong. It is going to be interesting if they are able, by such bone changes, to be so specific in their opinion that it is

prostatic carcinoma with evidence lacking of malignancy elsewhere.

Dr. HOMER G. HAMER (Indianapolis): As to prognosis, it has seemed to us that the results were no better where radium or x-ray therapy was used, in the treatment of obstructing cancer of the prostate, than where removal of the obstructing growth was undertaken without radiation treatment.

Dr. HERMAN L. KRETSCHMER (Chicago): I would like to make a few remarks regarding the subject of bone metastasis in carcinoma of the prostate. It is a well-known fact that carcinoma of the prostate, breast, and thyroid, as well as hypernephroma have a predilection to produce bone metastasis. These bone changes are readily recognized, as a rule, by the roentgenologists as metastatic carcinomata of the bone. Two types of metastatic carcinoma of the bone are recognized. In one, as is well-known, there is a production of new bone, the so-called osteoplastic, and in the other there is bone destruction, the so-called oesteoclastic. And sometimes one can have both types occur in the same film. On the other hand, an interpretation of these bone changes is not always as simple as it may seem. We have had several patients under observation in whom the x-ray men made a diagnosis of metastatic carcinoma of the bone from their x-ray films. Two of these patients have been under observation for five or six years and in both of them the bone picture has changed very little. In going over the situation with the x-ray men they have raised the possibility of these being probably cases of Paget's disease.

Dr. J. DELLINGER BARNEY (Boston): I think it is worth while to call attention to the fact that metastasis of the bone and of the soft parts may occur without necessarily making any x-ray changes. This is probably generally known.

I saw a case this last winter which was of interest to me, of a man who had no urinary symptoms whatever, but who had increasing pain in the right leg. His family doctor, in the course

of his examination, found a suspicion of carcinoma of the prostate. I was asked to see the case and confirmed the suspicion that the man had carcinoma of the prostate involving the right lobe. The patient progressed pretty rapidly from disability to paralysis of the right leg with hyperesthesia, with later involvement of the left leg, and he was eventually completely paralyzed in the lower extremities. He eventually died. He had a rather rapid demise and at autopsy, we found the lumbar glands badly involved and a growth within the spinal column but outside the dura. This was quite extensive and pressed upon his spinal cord to the extent of producing the paralysis. Yet the x-rays in that case, which were done on two or three occasions, had repeatedly shown no changes whatever.

Another point I would like to bring up is the great value of doing perineal prostatectomy in cases of recognized cancer of the prostate with the idea of giving relief. I have done this in a good many cases with great satisfaction to the patient and myself but I have failed to cure them. I would like to get a statement from somebody as to how many cases are actually and permanently cured where the diagnosis of prostatic cancer has been made before operation and operation done with the idea of relief. Perhaps I am not skillful enough. I would like to know how many cases have been cured by others.

Dr. WILLIAM F. BRAASCH (Rochester, Minnesota): Reference has been made to the difficulty of diagnosis of cancer of the prostate gland. It has been my experience that it is frequently impossible to make an exact clinical diagnosis. I have repeatedly observed a gland which was clinically 100 per cent benign, which at operation was found to contain carcinoma; and others which I thought quite certainly were malignant proved at operation to be benign. The suggestion of Dr. Barringer is a very good one and I hope we can try it out.

I am glad Dr. Kretschmer brought up for discussion the difficulty of x-ray diagnosis in metastases. I wish we could have a symposium on this subject at our next meeting with the roentgenologists. The diagnosis of metastases from carcinoma of the

prostate, the bladder or the kidneys, in the bones or in the chest or elsewhere, is far from being standardized. I have seen case after case where I have taken the x-ray plates to the roentgenologists on our staff for diagnosis and they have all given different opinions as to the identity of the lesion present. I confess that I am often very much at sea in knowing whether to attribute suspicious shadows in the roentgenogram to metastasis, Paget's disease, fibrosis, or one of many other lesions. We are far from being certain as to one interpretation in this field.

SECOND DAY, MAY 1, 1928

A CONSIDERATION OF BLADDER TUMORS WITH SPECIAL REGARD TO THERAPEUTIC MEASURES BEST SUITED TO THE DIFFERENT TYPES[1]

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Before the introduction of fulguration and radium therapy, the only means at our command for the treatment of bladder tumor was a surgical one. The necessity of differentiating one type of bladder tumor from another was a matter of trivial importance.

The first effort of the surgeon for the cure or destruction of the bladder tumor entailed a suprapubic exposure and cauterization of it by means of the hot iron or by the more modern forms of cautery. If the tumors were pedunculated or even sessile, but noninfiltrating, the immediate results were entirely satisfactory in that the growth could be completely eradicated. As these cases were followed subsequently, however, it was soon found that bladder tumors had an extraordinary tendency to recur. In many instances in which the operator had succeeded in removing a simple single growth, multiple tumors were found some months later. A second operation with destruction of the recurrent tumors would again be followed by recurrence. While occasional cures were obtained and ultimate freedom from recurrence secured, this happy result was exceptional, most of the

[1]The statistics cited in this paper are taken from the excellent review of 622 cases of bladder tumor treated at the Brady Urological Clinic made by Drs. W. W. Scott and Robert W. McKay. Their paper appeared in the New York State Journal of Medicine, 1927, xxvii, 939-949. The author takes pleasure in acknowledging his indebtedness to these gentlemen.

patients eventually dying of extensive carcinoma of the bladder. The results were so discouraging that many urological surgeons advised operating only in cases of necessity for the relief of some complication. The failure of the surgical procedure in this type of tumor is due not so much to the procedure itself, but to the lack of means of treating recurrence. Tumors of this type can be thoroughly and effectively destroyed by cauterization but the growth of new tumors cannot be prevented.

When the tumors were infiltrating, especially deeply infiltrating, very few if any satisfactory results could be secured by any methods of cauterization then available. The rapid realization of the ineffectiveness of these methods for the cure of infiltrating tumor led the bolder surgeons to attempt resection. The results obtained by the radical resection of the tumor area with a margin of healthy bladder wall gave surprisingly excellent results which led many surgeons to adopt this method absolutely in tumors of noninfiltrating type. The results, however, in this latter group were not as satisfactory, so far as ultimate cure was concerned, because of the greater tendency to recurrence. The suprapubic exposure of these noninfiltrating types of tumors resulted not infrequently in tumor implantations at points in the bladder previously uninvolved as well as in the suprapubic tract.

With the introduction of fulguration by Beer in 1910, there began a new era in the treatment of the more benign papillomatous tumors. More recently the introduction of radium has proved of great value in the more malignant forms of tumor.

The object of this paper is to show the necessity of careful differentiation of the different types of tumor and to point out forms of treatment which experience has shown will give the best results. For example, in one group fulguration will be successful; in another group resection is the method of choice; in another radium applied to the surface of the tumor will suffice; in another in which fulguration, resection or surface application of radium is not applicable, implantation of radium in the form of needles or as the emanation will yield results in cases hopeless to any other form of therapy.

It has usually been our custom in the classification of bladder

tumors to differentiate one tumor from another histologically. Thus papillomata were divided into the benign and malignant types. In the former group were included those tumors in which the epithelium lining the connective tissue axis had a palisade arrangement at the base, above which were several layers of oval, long tailed cells, all of which were of uniform size and shape and took the stain with uniform intensity. The papilloma was considered malignant when this uniformity in the size, shape and staining characteristics was lacking or when the connective tissue axes of the tumor were infiltrated.

When infiltration of the pedicle of the tumor or the bladder wall was present, the tumor was no longer regarded as a papilloma but was termed a papillary carcinoma. It should be noted, however, that in many of these malignant types of tumor, particularly the malignant papilloma, many portions of the tumor, often the major part of it presented a perfectly benign appearance histologically. On the other hand it was occasionally observed that in an apparently benign tumor a careful and painstaking search would finally establish its malignant character. In many of these cases therefore where a single block of tumor tissue was removed for section, a diagnosis of the benign type was made, whereas if other specimens of the tumor had been examined, definite histological proof of malignancy would have been forthcoming.

The classification to be adopted in this paper is not one based upon the histology of tumors, as this has proved in our experience to be of very little practical value. The difference histologically between the benign and malignant papilloma is of no practical value. Both types of tumor will usually respond equally well to the same type of therapy. The only practical advantage of this differentiation is that one can predict somewhat more accurately that there will be a greater tendency to recurrence in the case of the malignant papilloma. A section of the flat noninfiltrating papillary carcinoma may not differ at all from the histological picture presented by the tissue obtained from the surface of the papillary tumor the base of which is deeply infiltrating. If one were to depend upon the histological picture alone, the form of therapy successful in one should be equally successful in the other.

Our practical experience, however, has shown distinctly that this is not true. Radium applied to the surface of the noninfiltrating papillary carcinoma will usually effect its removal but when applied to the deeply infiltrating tumor, it is useless and even harmful.

In a long series of cases, pieces of tumor were removed in all cases in which this was possible and the histological picture was compared with the cystoscopic appearance of the tumor. It was observed that the data obtained from careful cystoscopy, symptoms and palpation furnished very much more reliable information as an aid to the selection of the form of therapy which would yield the best results.

The pathologist can tell us with more or less accuracy whether or not the tumor is of the benign or malignant type. He cannot, however, advise us of the extent and depth of involvement. This information is more accurately furnished by the cystoscope. *The pathologist rarely furnishes any information of value to aid the urologist in the selection of the therapeutic procedure best adapted to any given case.*

It is proposed that from the standpoint of therapy, bladder tumors be divided into two general groups, the differentiation being based upon the presence or absence of infiltration of the tumor pedicle or bladder wall. While errors in interpretation are bound to occur, our statistics show that untreated tumors which are clean and vascular and not associated with cystitis or evidence of edema about their bases, should be regarded provisionally at least as noninfiltrating and treated by endovesical therapy. These tumors which will include papillomata and the clean vascular sessile type of papillary carcinoma are usually not very difficult to recognize. The same may be said of the more extensive infiltrating tumors. The greatest difficulty in a correct cystoscopic interpretation will be presented by tumors in which the infiltration is confined to the pedicle or extends only superficially into the bladder wall, or in which because of the size of the tumor, inspection of the mucosa contiguous to the pedicle is impossible. However this particular group of tumors in which there is uncertainty as to the degree of involvement, it has been

our custom to regard them as belonging to the noninfiltrating type and to treat them accordingly. If they respond to this treatment well and good; if they do not, little has been lost, for it is generally believed that there is slight risk of early metastasis in superficially infiltrating tumors.

Practically all of the noninfiltrating types of tumor will respond to the so called endovesical methods of treatment which consist of fulguration, the application of radium to the surface of the tumor and to a combination of these two procedures. Most of the papillomatous tumors will respond to fulguration alone. There are certain tumors of this group, however, which are resistant to this method of treatment and it is our custom in all papillomata, except the villous type to give from 300 to 600 mgm. hours of surface radium preliminary to fulguration, as experience has shown that the tumor is thereby rendered more vulnerable to this procedure.

In one of our early cases in which an histological study had resulted in a diagnosis of malignant papilloma, the value of preliminary radiation was most convincing and led to the very frequent employment of this therapeutic measure combined with fulguration in the papillomatous types of tumor. This patient was first treated by fulguration at monthly intervals for a period of about six months. At each treatment the tumor which was $1\frac{1}{2}$ cm. in diameter was vigorously fulgurated and apparently completely destroyed. At the next cystoscopy, however, the tumor gave no evidence of ever having been treated, being of the same size and appearance of the original growth. After six months of fulguration, five hourly treatments of 100 mgm. of radium applied to the surface of the tumor was followed by vigorous fulguration which resulted in its eradication. This patient died of pneumonia four months later and a careful autopsy gave no evidence of recurrence or metastasis.

If on the initial cystoscopy surface necrosis is noted in a previously untreated tumor or if a tumor has been subjected to fulguration and the slough fails to separate promptly, the tumor should be regarded as infiltrating and not suitable for endovesical therapy. The proper method of attack will often differ with the personal

preference of the operator, but most authorities are agreed and our statistics support the conclusion, that resection with a wide margin of healthy bladder wall will give the best results.

Thus in sixty-eight cases of infiltrating tumor of the bladder in which resection was carried out there were six postoperative deaths. Twenty of the patients or 32 per cent were well for one year or more while 13 or 20 per cent remained well for five or more years. It is interesting that in this series of sixty-eight cases, the ureter was transplanted fifteen times. In this latter group there were six or 40 per cent cures, four of the patients being alive and well nine years after operation and two dying from other causes several years after resection.

Multiplicity of the tumor or involvement of the trigone or vesical orifice may render resection impossible and a choice between radium implantation or diathermy must be made.

While our experience in the use of diathermy in the treatment of infiltrating tumors of the bladder is so limited that it is unfair to draw any definite conclusions regarding its relative value, our personal preference inclines us to employ radium implantation in these cases. The technique we have followed consists first in free mobilization of the bladder followed by a surface destruction of the tumor by means of cautery, thus diminishing the likelihood of tumor implants. Platinum points each containing 1 mgm. of radium element are then plunged into the base of the tumor, 1 mgm. being used for each square centimeter of tumor surface. In cases of extensive malignancy, particularly if the vesical orifice be involved, the small points are reinforced by spears each containing 10 or 12.5 mgm. of radium element. The radium is allowed to remain in situ from twenty-four to forty-eight hours depending on the degree of bladder wall involvement. In this way a radiation totaling 1200 to 2400 mgm. hours can be obtained. In thirty-four cases (17 per cent) of infiltrating tumors in which this technique was employed, six patients were well for one year or more.

The employment of cautery in the treatment of bladder tumors should be limited to the surface destruction of the tumor preliminary to resection or implantation of radium. That this

therapy will succeed in destroying superficial neoplasms is undoubted, but this type of tumor is best and most safely handled by endovesical means.

In recent years many claims have been advanced favoring deep x-ray therapy. In our experience this agent has been of greatest value in ameliorating the pains of nerve involvement. In ten cases of extensive and deeply infiltrating tumor this method alone was employed and in none of these cases was any marked improvement noted. In thirty-seven other cases receiving radium and deep x-ray in combination an apparent cure was obtained. It seems apparent therefore that this form of therapy is most effective if the tumor is first subjected to a series of radium treatments.

CONCLUSIONS

1. Much of the confusion in the past regarding the most appropriate treatment to be applied to any given case of bladder tumor is the result of the present classification which is based upon the histological findings in fragments removed by cystoscopic means. We have repeatedly demonstrated the great possibility of error in basing a diagnosis upon the histological study of a single specimen thus obtained.

2. In so far as the so called papillomata are concerned the differentiation between benign and malignant types is of no practical import from the standpoint of therapy as both respond to a combination of radium and fulguration.

3. In case of the so called papillary carcinoma, greater confusion is present as the noninfiltrating tumor of this type may present a histological picture identical with the tissue obtained from the surface of a tumor the base of which has extensively infiltrated the bladder wall. An early differentiation of these two types of tumor is most essential as the former usually responds to surface application of radium and the latter requires an extensive surgical procedure.

4. It is proposed that much of the confusion created by the histological classification will be obviated by replacing it with one based upon the cystoscopic findings alone. Under this classifica-

tion tumors would be designated as either noninfiltrating or infiltrating. The experienced cystoscopist will usually have little difficulty in making this differentiation. In border line cases, however, the tumor should be regarded, tentatively, as noninfiltrating and treated accordingly.

5. Experience has shown that practically all of the noninfiltrating tumors will respond to endovesical (cystoscopic) means, consisting of radium and fulguration alone or in combination. In the infiltrating type these methods are contraindicated.

6. All of the infiltrating tumors so situated as to permit resection should be so treated even though transplantation of the ureter is necessary. In other tumors which are too extensive or involve the vesical orifice and prostate, the implantation of radium is recommended.

TWO YEARS' EXPERIENCE IN THE TREATMENT OF BLADDER CARCINOMA BY SUPRAPUBIC IMPLANTING OF METAL SEEDS CONTAINING RADIUM EMANATION

EDWARD L. KEYES

The technique which I have employed has been previously described (1,2). Enough time has elapsed to have crystallized some notions concerning the benefits, dangers and inconvenience of this method of treatment. This report concerns the history of 31 patients, suffering from tumor of the bladder, upon whom radium emanation implantation was performed after the bladder had been opened suprapubically. During this period six other patients have been refused operation because their disease was too extensive. During the same period, radium emanation has been implanted through the cystoscope upon 7 patients. Six of these have been relieved of their tumors by cystoscopic implantation alone or combined with fulguration. One died in ten months of cardiac decompensation. As this speaks for a relatively low clinical malignancy,[1] these cases are not discussed here. It is expected that they will remain well.

Seven of the operated cases had received ineffectual cystoscopic treatments by fulguration or radium implantation treatment preceding operation. As will be seen in the charts, a number of the patients have required subsequent cystoscopic fulguration or radium implantation in order to complete the elimination of

1 The variable relation of clinical and pathological malignancy has been discussed elsewhere (1, 2). Two of the patients relieved by cystoscopic treatment had tumors so large that before implantation it was impossible to estimate their size or even to appreciate the relation of the first implantation to the base of the tumor. One of them must have been of considerable malignancy for it disappeared after two implantations of radium. The other required a number of fulgurations. These two cases are mentioned inasmuch as they would have been treated by operative implantation if their condition had permitted.

certain tumors or to attack recurrences in other parts of the bladder.

At the onset of this work, I was keen about immediate suture of the bladder without drainage because of its efficacy in minimizing pelvic cellulitis and its virture of permitting early postoperative cystoscopy and further treatment to tumors inadequately controlled. (The alternative of post-operative treatment through the suprapubic wound has not greatly appealed to me.)

This suture without drainage of the bladder I still consider ideal, yet among 37 operations, 11 were drained, 26 sutured without drainage and 11 of these broke open. The 15 that did not leak left the hospital on the average of the fifteenth day. Those that were drained or that broke open continued to have a suprapubic fistula on the average for twenty-three days.

No account is taken in this report of other operations such as the repair of hernia or the removal of prostatic obstruction, since these did not complicate the patients' histories in so far as the tumor and its treatment were concerned.

The usual occasional incidence of diabetes, syphilis and cardiovascular complications was found but inasmuch as these seem to have had no influence upon prognosis, no note is made of them. The ages of the patients ranged quite evenly from 39 to 74 years at the time of operation. One patient operated upon in her 82nd year for a small recurrent tumor of papillary character was sutured without drainage and left the hospital on the eighth day to remain in bed at home for ten days longer.

The convenience of re-operating these patients has seemed of less importance as increased experience has equipped me to deal more satisfactorily with the tumors at the first operation. But 6 of the 31 patients have been submitted to more than one operation and but 2 to more than two operations, though 1 of my patients, to whom I refused the second operation because I believed his tumor incurable, persuaded another surgeon to open the bladder and implant more radium—without deferring the unhappy issue.

TYPE OF TUMOR

The tumors have been classified on the following clinical-pathological basis.

Papilloma (4 cases—pure papilloma by microscopical examination or specimen not examined). The papillomata are classed in the tables as Type I.

Low malignancy tumor (2 cases). These and all of the following types have been diagnosed microscopically as malignant growths, but the apparently slight clinical and microscopic malignancy of these tumors has seemed to justify setting them apart as Type II.

Papillary carcinoma (11 cases). This class, which in our tables appears as Type III, we have separated from the infiltrating growths on the bases of clinical observation. Inasmuch as the operation employed merely removed that portion of the tumor which projects into the bladder cavity, the microscopical examination cannot determine the extent to which the bladder wall is infiltrated. As papillary carcinoma we have classed those cases that showed no palpable infiltration of the bladder wall.

Infiltrating carcinoma (14 cases). These cases, classed as Type IV, differed from the preceding only in that examination before operation detected palpable infiltrated, hard masses or inspection at the time of operation revealed the tumor to be of the ulcerating type or to form a hard mass of infiltration in the bladder wall. Pathologists would differ as to the relative malignancy of various numbers of Types III and IV and the clinician also recognizes that tumors which show a primarily preponderant tendency to ulcerate rather than to form papillary growths, are much more to be feared, both because of the difficulty in local eradication and because of the danger of early metastases.

But this pathological point of view envisages the prognosis of tumor from its native malignancy. The clinician must establish his prognosis on the basis of the malignancy of the tumor at the time of his operation, and it is not yet clear that this clinical attitude toward malignancy warrants any finer distinctions than those set down in the above classification.

It has long ago been observed that certain types of very malignant tumors, such as the more rapidly fatal types of malignant teratoma of the testicle, are by virtue of this very cellular proliferation made vulnerable to treatment by radiation. Barringer believes that this principle can be applied in reference to the prognosis of radiation treatment of bladder tumors. The thesis seems useful at the lower end of the scale of malignancies. Certain papillomata are singularly resistant to radiation but can be eliminated readily enough by fulguration. Yet radiation which is so incompetent to deal with the more scirrhous types of certain other tumors, is, for anatomical reasons, the only treatment applicable to the more malignant types of bladder tumors. Thus Beer, one of the most skilful technicians in resecting the bladder, recognizes a class of cases that is beyond the possibility of resection and has relieved a minority of these by the implantation of radium. These non-resectable tumors are, generally speaking, those which infiltrate the trigone or the bladder neck.

OPERATIVE MORTALITY

Thirty-seven operations for implantations of radium and 1 resection of the bladder have been performed upon these 31 patients. The resection resulted fatally (case XVII). One of radium implantations resulted fatally (case VII).

The cases herein classified as Type IV would have required total cystectomy to offer them any other prospect of relief than that offered by radium.

RADIUM BURN

It is alleged by the makers of certain types of "seeds" containing radium emanation that the metal protection is such as to eliminate the possibility of radium burn. Clinical experience does not seem to justify this claim. Barringer states that ulceration of the bladder following radium implantation is the result of radium plus infection. This theory does not seem to explain that type of ulceration of the bladder which follows irradiation of the cervix uteri and is also illustrated in case XI, nor has it seemed to accord precisely with our clinical observation.

After our first few experimental cases, the system was established of implanting one seed containing radium emanation as nearly as possible at each corner of each cubic centimeter of malignant tissue. Excepting a few of the infiltrated cases, the description might read "in each corner of each square centimeter of surface involved in carcinoma." The surface layer of seeds is planted as accurately as possible at a depth of about 0.5 cm.

The resulting irradiation does not seem to accord with the type (gold, platinum) of seed used or the presence of cystitis at the time of operation. Note the varying degrees of infection in cases III, XII, XXIII, XXV and XXX.

Incrustation, of course, occurs both before and after operation as a result of infection and quite independently of the use of radium.

Special attention is called to the persistence of infiltration palpable by rectum or vagina in cases XVI and VIII, and to the late radium ulceration in case XI, the character of which has been explained by Dean.

The pelvic abscesses of case XXX are also in large part attributable to radium. This patient has suffered months of torture, yet he is alive to-day and gaining weight and able to work. If one may judge from previous experience with the implantation into the bladder of glass seeds containing radium emanation, it is quite possible that his tumor has been eradicated.

FAILURES

Complete failure includes the operative and the tumor mortality as well as those patients whose tumors one can foresee will not be controlled. Failure to control the tumor by operation may be partial or complete. Partial failure may be shown by continuance or reappearance of tumor in situ or by the subsequent appearance of tumors in the bladder, ureter or urethra in sites where nothing had previously been observed. Doubtful cases are those who have been operated upon so recently that a decision can not be arrived at.

There were 31 patients. One died within three days of opera-

SUMMARY OF CASES

NUMBER	NAME	SEX	AGE	TYPE OF TUMOR	MONTHS SINCE FIRST SYMPTOMS	NUMBER OF TUMORS	NUMBER OF SEEDS AND MILLICURIES		DRAIN	DAY				RESULT			CYSTOSCOPY	SEEN	DIED
							Gold	Platinum		Broke open	Post-operative fistula closed	Spasm	Bladder improved	Uncontrolled	New tumor				
			yrs.																
I	Ch.	M.	72	I	36	1		5 × 2										19 mos.	
II	Me.	M.	74	I	1	4	20 × 1.5		+		4	4	14			Bladder neck punch—14th day bled—suprapubic		4 mos.	
III	Schr.	M.	64	I	6	8+	20 × 1.5									Post-operative stone–Paxy	17 mos.		
IV	Cr.	F.	82	I	+	1		5 × 1.5							15 m.		18 mos.		
V	Mo.	M.	39	II	12	3	10 × 1.5		+		25						5 mos.		
VI	Ro.	M.	55	II	1	14	11 × 1.5					+	2 m.		11 m.	Into this 3 gold 1.5 cysto—3 m. later cystoscopy negative. Seven m. later 6 new ones fulgurated			
VII	On.	F.	76	III	+	4	20 × 1												3 days
VIII	Gr.	F.	66	III	9	1		12 × 2.5				30	60			Primary carcinoma right kidney pelvis—nephrectomy	17 mos.	21 mos.	
IX	Schw.	M.	65	III	7	1	10 × 1		+		28					Excision of prostatic bar	5 mos.	1 yr.	
X	Bul.	M.	60	III	7	3	15 × 2			8	33						13 mos.		
XI	Ca.	M.	49	III	6	3	14 × 1.5							+		Fulgurated 6 m.—ulcer at 16 m.	16 mos.		

XII	Hi.	M.	40	III	20 yrs.	2	12 × 1.5		+		28							2 mos.	
XIII	Por.	F.	50	III	18	1		3 × 3	+		23			+		No tumor at 2 m.—reappeared at 4 m.			
					4+	1	3 × 1.5		Cysto.							No fulguration	15 mos.		
XIV	Ba.	M.	54	III	6	+	20 × 1							+					
				III	3+	+	13 × 1.5		Cath.							Repair appendix hernia	13 mos.		
XV	Pa.	M.	54	III	2	1		6 × 2.5	+		21			+	↓				
					3+	1		3 × 3 Cysto.							+	+ 4 fulgurations			
					10+	1	1+3×1.5 Cysto.									(Urethral recurrences) + 10 fulgurations	2 yrs.		
XVI	Fra.	M.	44	III	15	1		10 × 2.5	+		21	+	24	+					
				III	11+	1	15 × 1.5							+					
				III	3+	1	5 × 1.5 Cysto.					+		+					
				III	1+	1	25 × 1			1	42	20		+				11 mos.	
XVII	Pow.	M.	47	III	18	+	→		+			+		+		18 × 0.5 glass			
					22+	+	→		Cysto.			+				3 + 1 × 0.5 glass: later 1 × 2.5 platinum			
					4+	1	1 × 1.5					+				+ 5 fulgurations + 2 × 2.5 platinum: then 1 × 2.5 platinum			
					7+	+	11 × 1.5			4	30	+				+ 3 fulgurations + 2 × 1 platinum: by cystoscope: then 1 × 2.5 platinum			
					5+	+	→					+				Resection—ileus			5 days
XVIII	Buc.	M.	54	IV	6	1		6 × 2.5		5	14	+		+					8 mos.
XIX	Bird.	M.	44	IV	4	1	30 × 1			6	13	14						2 mos.	
XX	St. Jo.	M.		IV	48	1	15 × 1.5		+		19			+		Blood counts improved			7 mos.
XXI	Scha.	M.	59	IV	8	1	5 × 1.5							+					7 mos.

SUMMARY OF CASES—*Continued*

NUMBER	NAME	SEX	AGE	TYPE OF TUMOR	MONTHS SINCE FIRST SYMPTOMS	NUMBER OF TUMORS	NUMBER OF SEEDS AND MILLICURIES: Gold	NUMBER OF SEEDS AND MILLICURIES: Platinum	DRAIN	DAY: Broke open	DAY: Post-operative fistula closed	DAY: Spasm	DAY: Bladder improved	RESULT: Uncontrolled	RESULT: New tumor		CYSTOSCOPY	SEEN	DIED
			yrs.																
XXII	Te.	M.	66	IV	48	1	20 × 1.5		+		22	+		+		High blood chemistry			3 mos.
XXIII	Bier.	F.	50	IV	6	1	15 × 1.5			5	21	60		+					13 mos.
XXIV	Da.	M.	72	IV	10+	1	20 × 1.5			5	13			+				3 mos.	
XXV	De.	F.	70	IV	12	1	30 × 1		+		42			?				2 mos.	
XXVI	Fa.	M.	67	IV	48	1	30 × 1					1	50±				9 mos.		
XXVII	Fl.	M.	64	IV	3	1	17 × 1					+		+					11 mos.
XXVIII	Ga.	M.	63	IV	2	1		3 × 2.5						+					27 mos.
XXIX	Be.	M.	69	IV	24	1	30 × 1			6	26				11 m.				
				IV	11+	1		4 × 2.5 Cysto.									1 mo.		
XXX	Bo.	M.	43	IV	6	1	32 × 1		+	+	?	+	?	+					
				IV	6+	1	9 × 1.5		+	+	16	+	?	+				6 mos.	
XXXI	Sm.	M.	52	IV	17	1	6 × 1.5							+		Prostatectomy 1 year before operation			
					3+	1	7 × 1.5						?						
					13+	1	4 × 1.5 Cysto.										3 mos.		

tion. One died of resection following failure to control a Type III tumor by four radium implantations, over a period of almost five years. Six other patients have died of carcinoma at intervals varying from three to 27 months after operation. All of them were Type IV tumors.

I have classified as uncontrolled one Type I case (case IV) although the tumor to which the radium was applied had not recurred. A similar situation arose in connection with one of the Type II cases. Among the 10 Types III cases that survived the first operation (one died), one required subsequent fulguration but is now clear of tumor, one required subsequent cystoscopic implantation of radium emanation, one required both cystoscopic implantation and fulguration, one required two supra-pubic operations. The tumors of all of these patients have disappeared as certified by cystoscopic examination.

Type III. Two cases were uncontrolled by repeated implantations, both cystoscopic and supra-pubic (cases XI and XVI). Two cases operated upon within the last two months are too recent for classification.

The prognosis of Type III tumors therefore may be summarized as one operative death in 11 cases, 2 uncontrolled, 6 controlled and 2 recent.

Among the 14 palpable infiltrating cases, there have been 6 cancer deaths, as stated above. Among the remaining 8, 3 are apparently controlled (cases XXVI, XXIX and XXXI).

CASES OF BLADDER PAPILLOMA

Case I. Ch., male, seventy-two years. Microscopical diagnosis, papilloma, auricular fibrillation. The patient had an almost fatal attack of auricular fibrillation a year ago and since that time has constantly taken digitalis under medical advice.

One hematuria two years ago, recurrence three months ago and several times since. Urination once at night, every three hours by day, stream sometimes slow, no pain. No loss of weight.

Urine contains pus cells. Non-protein nitrogen 31 mgm.; rectal examination negative; bimanual examination negative; cystoscope shows a large papillary tumor of which only a small section can be seen at one

time. It seems solid and I concur in the opinion of another urologist that it is malignant but differ with his opinion that it is inoperable.

FIG. 1. (CASE I.) AIR CYSTOGRAM BEFORE OPERATION

February 27, 1926. Suprapubic section reveals a bladder tumor the size of a golf ball with a small base just back of the right ureter. Tumor

clamped and cut off distal to the clamp; plain catgut ligature proximal to the clamp; 5 platinum tubes each containing 2 mc. of radium emanation implanted about the pedicle; sutured without drainage. Patient had no pain after operation. Pathological report—papilloma.

May 7, 1926. Urination normal. Urine hazy. Rectal examina-

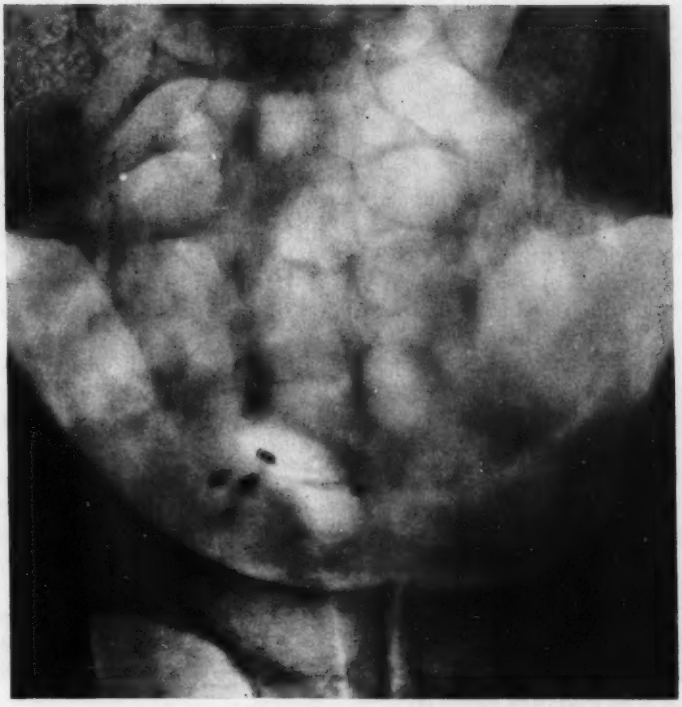

FIG. 2. (CASE I.) AFTER OPERATION

tion negative. Cystoscope shows cystitis, a slough about 1 cm. in diameter external to right ureter. No tumor.

May 23, 1926. Cystoscope reveals no trace of tumor or radium burn. Urine still shows a few pus cells.

September 19, 1927. Cystoscopy negative but for a slight prostatic bar and some trabeculation. He still takes digitalis. He plays nine

holes of golf a day. The urine is free from pus. The x-ray shows the 5 platinum seeds still in the wall of the bladder.

Case II. Me., male, seventy-four years. Microscopical and clinical diagnosis, papilloma; enlargement of prostate. Hematuria, intermittent, six weeks; few pus cells; non-protein nitrogen 50 mgm., creatinin 2 mgm.; phenolsulphonephthalein 26 and 20 per cent; hemoglobin 80 per cent; red blood cells 4,150,000; cystoscope shows 3 papillary growths, (1) just back of right ureter, (2) contact inoculation in fundus, (3) a line of papillary fringes extending to the right from this contact mass and (4) one papilla on right side of bladder neck; prostatic bar concealing most of trigone.

April 28, 1927. Ethylene anesthesia. Suprapubic section. Twenty gold seeds of 1.5 mc. each implanted in a wee lesion to the right side of the bladder neck and in the 3 tumors running from the right of the right ureter orifice to the bladder neck on that side. The prostatic bar was then removed by a single punch and in order to guard against inoculation, a final radium seed was implanted on the edge of the cut on the left hand side. Small drainage tube.

May 7, 1927. Bladder healed on fourth day and he has had a good deal of radium spasm since. Pain occurs about every hour day and night. He takes morphine $\frac{1}{6}$ grain by hypodermic injection each night. Spasms are getting less.

May 12, 1927. Bladder remains healed. No spasms of any importance since above. Urine hazy. Last night began to bleed. This morning clots. Indwelling catheter fails to control bleeding. Ethylene. Suprapubic wound re-opened. A hand full of clots bailed out. Large suprapubic drainage tube. Transfusion of 500 cc.

May 13, 1927. After transfusion bleeding immediately stopped, respirations which had been irregular and sighing in character became normal. He had a good night's sleep. Today he recollects nothing since his spasms of yesterday morning.

June 9, 1927. Fistula healed. Night interval three hours; voiding freely, no burning. Day interval two hours easily but has slight irritation. Urine—hazy with slight trace of albumin. Convalescence since cystotomy May 12 uneventful. Tube left in about ten days; healed five days later.

September, 1927. Urine clear. Feels well. Refuses cystoscopy.

May, 1928. Reported well.

Case III. Schr., male, sixty-four years. Microscopical and clinical diagnosis, papilloma; post-operative ulcer and stone. Hematuria, intermittent, six months, terminal three months, frequent and slow urination one month.

Urine bloody, pus cells; non-protein nitrogen 62 mgm., creatinin 1.8 mgm.; left lobe of prostate feels slightly irregular suggesting possible

FIG. 3. (CASE III.) CYSTOGRAM BEFORE OPERATION

carcinoma; Cystoscope reveals the bladder filled with papillary tumor; Cystogram shows irregular extensive filling defect on left side of bladder; Recto-abdominal palpation discloses no mass.

December 3, 1926. Spinal anesthesia. Suprapubic cystotomy, exposing a mass of the papillary tumor which hid the bladder neck and trigone completely. A few small saccules. Tumor tissue on the left

side was removed with sponge forceps and the neck of the tumor grasped with gall bladder forceps above which the tumor was cut away and found to have a pedicle about 1 cm. in diameter; 4 gold needles 1 mc. each of radium emanation were implanted about this. The same procedure was followed on the right side, each tumor pedicle being 2 cm. back of the ureter. No secondary tumors were seen on the left side, but on the right side there were small secondary tufts running up the right lateral wall of the bladder for perhaps 3 cm.; 3 seeds were planted in these. Small tumors were then removed from the following regions: One long one on the right side of the bladder neck which required one seed, then a trail of papillary growths with narrow bases running from about the middle of the bladder neck on the left side up around the front of the bladder to the vertex, a distance of about 4 or 5 cm. These tumors were clamped and cut away and 8 seeds planted in their bases, 20 seeds being used in all. The bladder was sutured tight with plain catgut.

No complaint of post-operative irritation of bladder. No leak from suprapubic wound. Tongue dry for several days after operation.

January 3, 1927. Urinates four times at night, every two hours by day. Looks anemic. Hemoglobin 50 per cent; red blood cells 2,900,000. Urine cloudy with pus. Urination not painful. Cystoscope shows cystitis, a tight bladder neck, inflammatory papillae about trigone.

March 2, 1927. Has gained 15 pounds; hemoglobin 80 per cent; urinates every two or three hours; Cystoscope shows a mass of granulations just about a small diverticulum back of the left ureter.

May 17, 1927. Urination more frequent and painful for a month. Today passes a small stone. Radiogram of pelvis suggests bladder stone. Cystoscope shows only cystitis. Urine cloudy.

September 26, 1927. Cystoscope shows phosphatic stone in bladder.

September 28, 1927. Litholapaxy—stone 2 inches in diameter.

October 17, 1927. Cystoscope shows no stone, no general cystitis, some granulations. behind the right ureter and a small mass of phosphates adherent to the right side of the bladder neck. This point was burned with a high frequency current. Caprokol administered.

March 2, 1928. Fundus healed. The ulcer with the small stone adherent on bladder neck is still present. He has passed two stones in the meanwhile; ulcer burned again.

March 12, 1928. Burned again. Gomenol.

April 4, 1928. Right epididymitis.[2]

[2] July 20, 1928. Urine sparkles. No more stones passed. Appears well.

Case IV. Cr., female, eighty-two years. Clinical diagnosis papilloma of ureter and bladder. Eight years ago resection of bladder for tumor. Bleeding recurred four years later and has been controlled by cystoscopic implantation of radium and by fulguration with the high frequency current until the last six months. Patient is discouraged with cystoscopic treatments and refuses to have any more of them. She will not return to the physician who has been administering these treatments.

July 7, 1926. I therefore opened the bladder under spinal anesthesia, found a small papillary tumor overhanging the right ureter orifice and implanted 5 platinum tubes each containing 1.5 mc. of radium emanation about this. No drainage to bladder. Left hospital on eighth day. No irritation of bladder thereafter.

September and November, 1926. Cystoscopy negative. There is a mass 1 cm. in diameter palpable by vagina at about the point of radium implantation.

May 31, 1927. The lump is still palpable.

October 31, 1927. Hematuria. After the bleeding had ceased cystoscopy showed 2 very small papillary tumors high up on the right side of the bladder vault at a point difficult to reach with the cystoscope. These were fulgurated several times. No mass palpable.

February 3, 1928. Hematuria. Cystoscope shows the lower end of the right ureter distended with blood clot. The region into which radium had been implanted shows no tumor. The tumors on the vault are not controlled by the fulguration. Patient's physician advises her against any further treatment.

CASES OF BLADDER CARCINOMA OF LESSER MALIGNANCY

Case V. Mo., male, thirty-nine years. Pathological report, malignant papilloma. Occasional hematuria with pain in sacrum—one year. Chronic bronchitis—five years. Loss of weight—15 to 20 pounds. Rectal examination negative. Cystogram shows mass growing from right side of bladder.

December 21, 1926. Spinal anesthesia. Suprapubic cystotomy. The floor of the bladder could not be seen because of masses of papillary carcinoma. These were picked up one by one until it was possible to identify the base, which lay behind and rather lateral to the right ureter. The base was about 5 cm. long and took two clamps to hold it, on which the tumor was cut away. A single long papillary growth was found growing from the floor of the prostatic urethra just outside the bladder

neck. A single gold seed containing 1 mc. of radium was implanted into this. Two more were planted into a flattish small papillary growth near the upper part of the base of the main growth and eight more were planted on either side of the clamps holding the pedicle of this growth. (The whole fundus of the bladder was irregularly thickened but it was not clearly carcinomatous.) On removing the clamps one of them placed

FIG. 4. (CASE V.) AFTER OPERATION (CYSTOGRAM)

on the pedicle of the tumor slipped off but the bleeder was caught with a Carmalt clamp and this was left in place protruding through the abdominal wall with a small drainage tube (the clamp was removed 1 hour after operation; no hemorrhage). After removal the fragments of papillary carcinoma assumed about the proportion of a golf ball. One central mass was quite firm, its fringes webbish, the rest was quite soft.

January 6, 1927. Transferred to Medical Department for treatment of

pulmonary tuberculosis which radiogram reveals as the cause of the chronic bronchitis. Fistula closed at this time.

April 20, 1927. Has gained 20 pounds; feels perfectly well; has had one right renal colic. Cystoscope shows a wee ulcer just behind right ureter. No sign of tumor. A No. 4 F. ureter catheter readily enters right ureter.

Patient has not answered letter since this time.

Case VI. Ro., male, fifty-five years. Microscopical diagnosis, papillary carcinoma; diabetes. Intermittent, painless, terminal hematuria one year. Glycosuria seven years. For seven months past, urinates every two hours by day and once or twice at night. No loss of weight.

Carcinoma already diagnosed cystoscopically and resection advised. Urine contains trace of sugar, pus cells, trace of albumin. Non-protein nitrogen 42, creatinin 1.8. Blood sugar 174 mgm. (reduced before operation to 131). Rectal and bimanual examination negative. Cystoscope shows "multiple soft papillomata at bladder neck and behind each ureter."

October 19, 1926. Spinal anesthesia (patient became hysterical and ether to the obstetrical degree was given). Suprapubic section. A growth about the size of a cherry and with a very small stem was found back of the left ureter. This was clamped, tied off and 2 gold seeds of 1.5 mc. each of radium emanation implanted at its base. After its removal a line of papillary infiltration of the mucosa was found extending for about 2 cm. upward from this point and ending in two or three tufts of papillary tissue. These lesions were burned off with the actual cautery and 3 more seeds of radium emanation implanted there. Small papillary tufts were similarly treated to the left of the bladder orifice 1 tube), about 1 cm. from the bladder orifice (1 tube), at a point about 1 cm. back of and external to the right ureteral orifice (1 tube), behind the middle of the trigone on the inter-ureteric ridge (1 tube), at a point about 1 cm. back of this (2 tubes). Bladder sutured without drainage. Eleven seeds were implanted in all. Convalescence entirely uneventful. After operation painful urination continued a week. Patient left hospital on sixteenth day. Wound did not leak.

December 5, 1926. Cystoscopy shows radium burn, no tumor. Urination comfortable. Urine still cloudy.

February 16, 1927. A very small slough back of the left ureter and one high in mid-fundus. All else healed.

September 14, 1927. Cystoscopy shows small papillary growth at

apex of bladder neck. Three gold seeds containing 1.5 mc. each of radium emanation implanted.

December 12, 1927. Cystoscopy negative.

March 7, 1928. Recent terminal hematuria. Cystoscopy shows the bladder neck tumor: fulgurated.

March 21, 1928. I find and fulgurate satisfactorily (*a*) the bladder neck tumor, (*b*) one at contact point in vault, (*c*) one a little behind and to right of this, (*d*) two at contact point on fold and vault and fundus to left.

April 6, 1928. These tumors have disappeared. One new large and one small one on right side of vault fulgurated under caudal anesthesia.

April 20, 1928. All tumors gone excepting one to the right of the bubble which I fulgurate.

May 5, 1928. Bladder seems normal excepting for slough at the point of last fulguration. Patient urinates every two hours by day and once by night. Urine is hazy with pus.

CASES OF PAPILLARY CARCINOMA OF BLADDER OF GREATER MALIGNANCY

Case VII. On., female, seventy-six years. Microscopic diagnosis, papillary carcinoma. Intermittent hematuria for one year—recently profuse and constant. She is blind, tremulous, nervous, arteriosclerotic. She rebels at operation but husband insists that she be operated upon. She is so restless that it is impracticable to administer spinal anesthesia.

January 25, 1927. Suprapubic section. One large papillary tumor with a base about 5 cm. in diameter up the right ureteral wall from a point behind the right ureter. Three small secondary tumors, one of them 1 cm. back of the main tumor, the two others on the opposite side of the fundus.

Sixteen gold tubes containing 1 mc. each implanted along the base of the large tumor after this had been clamped and cut away; 2 seeds to the nearer small tumor and one each to the others; 20 seeds in all. Bladder sutured without drain. Operation lasted fifty minutes. After operation patient went into collapse and with ileus and anuria died in three days. Maximum temperature 100°, pulse 140. The blood pressure was 116/66 the day before her death.

Case VIII. Gr., female, sixty-seven years. Microscopical diagnosis, primary papillary carcinoma of kidney pelvis. Bladder implant resists

fulguration and cystoscopic application of radium. Controlled by suprapubic application of radium. This woman had suffered from profuse pulmonary hemorrhages in 1921 and in May, 1925, I had removed

FIG. 5. (CASE VIII.) AFTER OPERATION

the right kidney with the ureter down to the bladder but not including the vesical portion. She was lean, frail and dyspeptic.

October 9, 1925. Profuse hematuria—in Paris.

October 24, 1925. Cystoscopy shows the right ureter distended with blood clot and palpable by vagina. Two glass seeds containing 0.2 mc. radium emanation each implanted within the ureter.

A week later 2 more 0.5 mc. each.

When the blood clot disappeared the ureter was no longer palpable.

November 23, 1925. Platinum seed containing 2.5 mc. implanted in right ureter.

X-ray five days later shows that this seed had fallen out.

April 5, 1926. Recurrence of hematuria. Cystoscope shows clot in ureter mouth. No tumor palpable by vagina. Two platinum seeds 2.4 mc. each, 1 implanted in bladder over roof of ureter, 1 in ureter mouth.

April 13, 1926. X-ray shows only 1 seed.

April 30, 1926. 1 gold 2 mc. seed implanted.

June 1926. Hematuria followed by fulgurations (in Paris on June 19 and 26).

July 7, 1926. She returns to New York with a big sloughing ulcer 1 cm. in diameter just below ureter mouth covered with phosphates.

A week of 10 per cent argyrol irrigation dissolved the phosphates then cystoscope shows a fungating mass of tumor in the ulcer. Vaginal palpation against the cystoscope reveals no mass.

July 24, 1926. Suprapubic section. Papillary carcinoma growing from the ulcer at ureter mouth. Twelve platinum seeds 2.5 mc. each implanted. Bladder sutured without drainage.

Pads seem to be moist with urine from the seventh to the tenth day. No grave discomfort until four weeks after operation when she began to suffer radium burn spasms. These continued for one month when, for the first time, she declared herself free from all discomfort.

November 11, 1926. Ulcer 0.5 cm. in diameter over site of right ureter orifice. Hard mass the size of a lima bean palpable by vagina under this point. Patient feels perfectly well.

February 7, 1927. Cystoscope shows a flat, small spot of depression and puckering. Ulcer healed. By vagina the lump is for the first time much smaller.

November, 1927. Cystoscopy negative. Lump no larger than a pea.

May 1928. She feels perfectly well.

Case IX. Schw., male, fifty-five years. Microscopical diagnosis papillary carcinoma; prostatic bar. Hematuria intermittent seven

months. Chill and vomiting three weeks before operation and epididymitis two weeks before. No loss of weight.

Blood pressure 142/92. Urine purulent. Bimanual examination reveals inflammatory oedema of the prostate from previous cystoscopy. Non-protein nitrogen 58 mgm., creatinin 2 mgm. Cystogram shows filling defect of lower left third of bladder. Cystoscope shows fungating tumor lying against but not involving bladder neck, also a prostatic bar.

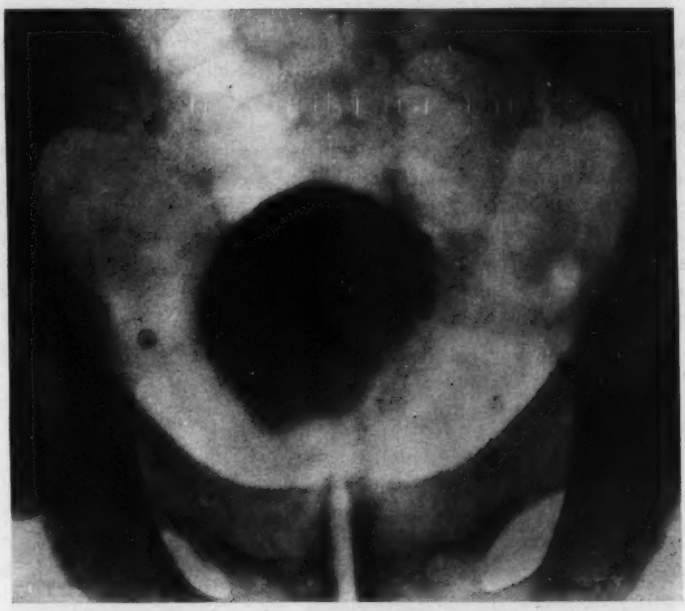

FIG. 6. (CASE IX.) CYSTOGRAM BEFORE OPERATION

May 16, 1927. Spinal anesthesia. Suprapubic section. Mushroom of papillary carcinoma about 3 cm. in diameter with a pedicle not more than 1.5 cm. in diameter snared off and ten 1 mc. gold seeds planted in its base and immediate neighborhood. Five more were planted in spots near by that might or might not be papillary. The prostatic bar was then removed by rongeur. Bladder drained.

The sinus took two months to heal. He continued to have cloudy urine, some frequency and some residual urine in spite of local treatment until April, 1927, when the urine became clear and the bladder emptied itself.

Cystoscopy was negative for tumor in September, 1927, and March, 1928.

Case X. Bul., male, sixty years. Microscopic diagnosis, papillary carcinoma. Two hematurias, one six months before and one immediately before operation. Pus in urine. Blood pressure 142/86. Non-protein nitrogen 45 mgm., creatinin 2 mgm. Cystoscope shows papillary growth from right side of bladder.

November 2, 1926. Spinal anesthesia. Suprapubic section. One large, soft, papillary growth with pedicle 3 cm. wide behind the right ureter mouth. Pedicle clamped, ligatured, tumor cut away. Ligature then fell off but pedicle did not bleed. Twelve gold seeds 1.5 mc. each implanted about it and 2 seeds into base of a secondary growth just above the primary one; one seed into a smaller secondary growth. No drainage.

Bladder broke open the 8th day and leaked until the thirty-third day. Convalescence otherwise uneventful.

December 12, 1926. Cystoscope shows mild cystitis, a wee ulcer at the site of the tumor.

In March and December, 1927, cystoscopy negative.

Case XI. Ca., male, forty-eight years. Microscopic diagnosis, papillary carcinoma of bladder; arteriosclerotic radium ulcer. Intermittent and terminal hematuria seven months. Urine cloudy with pus. Bimanual examination negative.

October 18, 1926. Cystoscope shows single papillary tumor back of right ureter. Fulgurated.

October 22, 1926. Fulgurated again. Specimen taken which was reported papillary carcinoma. Much more pus in urine and bladder irritation from fulguration in spite of bladder irrigations. Non-protein nitrogen 38 mgm., creatinin 1.3 mgm.

November 9, 1926. Spinal anesthesia. Suprapubic section. Tumor the size of a golf ball with rather small soft pedicle found growing behind and external to right ureter orifice. This was clamped, cut away and ligated and 10 gold seeds of 1.5 mc. each planted about its base. A small bunch of papillary tumor was then found growing from within the urethra.

As its base could not be seen, one seed was planted at each of the four cardinal points just within the ring of the sphincter. Bladder sutured without drainage.

Went home the eighth day. Convalescence uneventful.

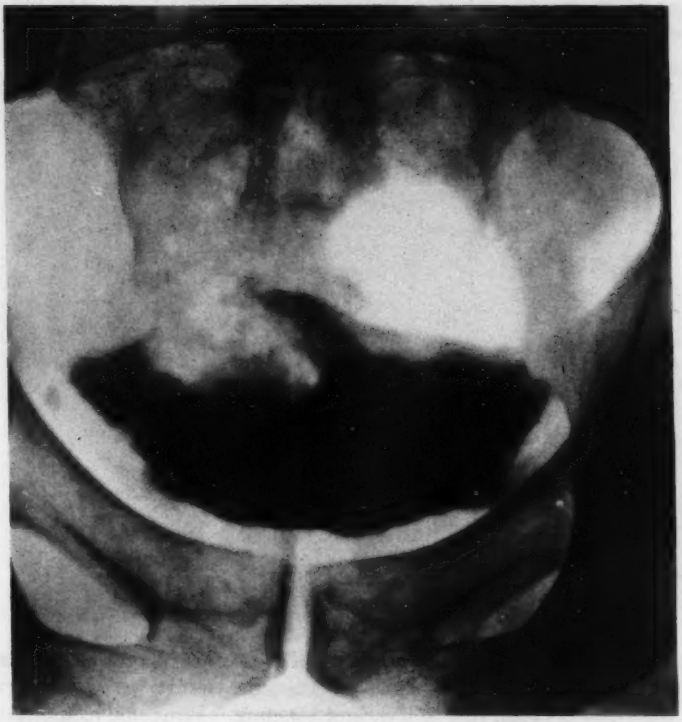

FIG. 7. (CASE XI.) CYSTOGRAM BEFORE OPERATION

November 9, 1926. Urinates once at night and every 3 hours by day. He states he has had no pain since the day he was operated upon.

December 6, 1926, January 31 and March 2, 1927. Cystoscopies show a small slough at site of bladder tumor.

April 29, 1927. Urethroscope shows papilloma growing from roof of posterior urethra. Burned with acid nitrate of mercury. Much pain

ensued. This same growth was fulgurated May 2, 1926, also June 29, September 13, November 29, 1927.

March 11, 1928. Urethral tumor has disappeared but at the point where the bladder tumor had been, there is an ulcer 1 cm. in diameter with sloughing base which looks precisely like the bladder ulcer one sees in the second year after radiation of the cervix uteri. The patient feels perfectly well.

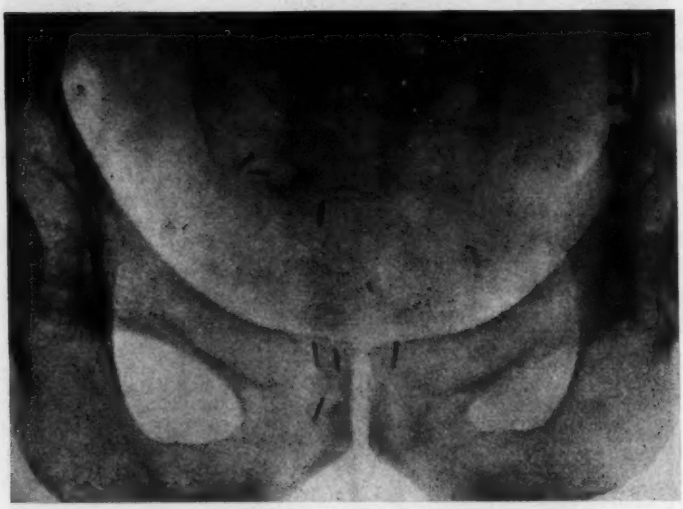

FIG. 8. (CASE XI.) AFTER OPERATION

Case XII. Hi., male, forty years. Microscopical diagnosis, papillary carcinoma. Intermittent painless hematuria twenty years. Interval of ten years between first and second bleeding. Bimanual examination negative. Cystoscope shows large papillary tumor behind right ureteral orifice and overhanging trigone. Transplant inside bladder neck at twelve o'clock.

March 2, 1928. Spinal anesthesia. Suprapubic section. A tumor about 3 cm. in diameter was found springing from the right lateral wall of the bladder a little distance above the trigone. This was lifted with a sponge stick and the base caught by two overlapping Carmalt clamps. The tumor was then cut away. It seemed soft and papillary. Re-

moval of the tumor exposed a small papillary growth in the upper segment of the bladder neck. Three gold seeds 1.5 mc. each were implanted inside this bladder neck tumor and with the clamps still in place nine more gold seeds were placed around the base of the larger tumor. The clamps were then removed without ligature of the pedicle. Subsequent arterial bleeding was slight and controlled by pressure with a pad for five minutes. Suprapubic tube. The small tumor at the bladder neck was not removed. Home twenty-third day.

April 10, 1928. Fistula closed. Voids every one and one-half hours night and day without pain.

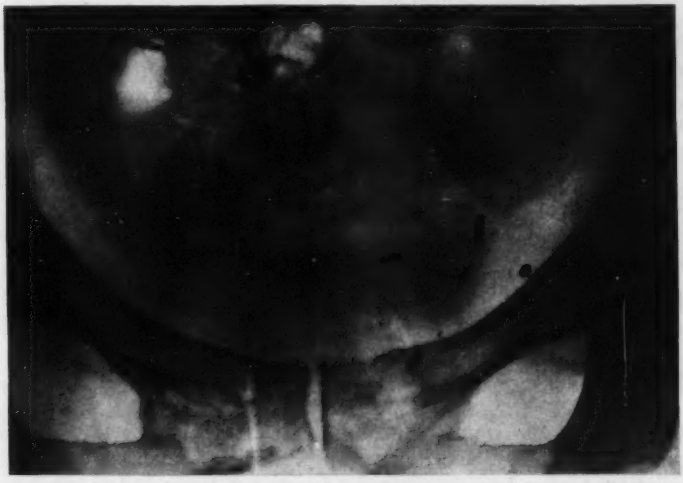

FIG. 9. (CASE VIII.) JUNE 7, 1926 (REVERSED) THREE PLATINUM AND TWO GOLD SEEDS

May 22, 1928. Cystoscopic examination under caudal anesthesia shows cystitis, ulcer to right of trigone. Tumor in urethral orifice at twelve o'clock well burned.

Case XIII. Por., Female, fifty years. Microscopic diagnosis, papillary carcinoma. Intermittent hematuria, one year. Frequent urination, 18 months. Has lost 30 pounds in the past year. Ankles swell at times.

Pus in urine. Blood chlorides 480 mgm. Vaginal and rectal examinations reveal only a cystocele. Cystogram shows a tumor filling the right side of bladder. Cystoscopy shows papillary tumor back of right ureter.

January 19, 1926. Ether anesthesia. Suprapubic section. Large papillary carcinoma clamped on right side of bladder. Base 5 by 2 cm., divided by cautery. Three platinum seeds containing 3 mc. each implanted into the base of tumor. (N.B.: I should today consider these seeds too strong and too few.) Bladder drained.

Fistula closed on twenty-fourth day: Four days later the cystoscope showed the tumor to be a mass of slough.

February 8, 1926. Cystoscope shows the tumor base still a mass of slough and with a distended bladder the seeds are shown by x-ray to be at least 3 cm. apart.

March 8, 1926. Linear scar at least 5 cm. long from right ureter mouth up the side of the bladder. Slough 3 by 1 cm. still adherent to its lower part.

May 24, 1926. Cystoscope shows a small area of papillary growth about 3 cm. below and to right of bubble. Slough has disappeared.

June 1, 1926. Three gold tubes containing 1.5 mc. each implanted by cystoscope.

June 7, 1926. Only 2 of these gold tubes are shown by the x-ray.

June 20, 1926. Cystoscope shows an ulcer at point of implantation of gold tubes.

September, 1926, and September, 1927. Cystoscopy negative.

Case XIV. Ba., male, fifty-four years. Microscopical diagnosis, papillary carcinoma. Intermittent hematuria six months. A tumor near left ureter has been fulgurated a number of times but is increasing in size. Bladder is becoming more and more irritable. Resection of bladder has been recommended.

Patient is over fat. Blood pressure 138/80. Pus in urine. Bimanual examination negative. Cystoscopy under general anaesthesia shows slight protrusion of right lateral lobe of prostate. A bunch of flat, papillary carcinomata and one big sloughing tumor back of left ureter. Two platinum seeds containing 2.5 mc. each were implanted through the cystoscope but it was felt that section would be required to control the tumor. Bladder was also irrigated daily and in a week it became very peaceful and the urine became clear.

December 7, 1926. Ether anaesthesia. Suprapubic section. An

area of papillary carcinoma, not really hard but of low lying, non-papillary spongy growth, covering the region behind and external to the left ureteral orifice and running thence in a band about 2 cm. wide nearly to the bladder neck on that side and behind the trigone, where it extended almost to the mid line and was 2 or 3 cm. wide. One smaller growth in front of the bladder neck. Gold tubes which contained 1 mc. were implanted. One into the small growth and 19 into the original growth, the part of the growths nearest the bladder neck and highest to the lateral wall being planted much more thoroughly than that part lying behind the ureter low down. Bladder sewed tight with plain cat gut.

Left hospital December 22, 1926. Fistula did not leak. He suffered a good deal of spasm during the first 24 hours after operation but thereafter he was comfortable.

January 24, 1927. Cystoscope shows tumor (probably) from 1 cm. behind ureter mouth up that side of fundus toward lateral bladder wall but not in the direction of the bladder neck.

March 2, 1927. Cystoscope shows a very small but definite spot of tumor just back of ureter surrounded by a number of irregularities suggestive of tumor.

March 15, 1927. Ether anesthesia. Hernia resulting from appendicitis operation repaired.

Suprapubic section. A small suspiciously granular area was found external to the left ureteral orifice (2 by 2 cm.) and a single small papillary growth in mid fundus. At the root of this, 2 gold 1.5 mc. seeds were implanted and 11 more around the area of the left ureter. Bladder sutured without drainage, catheter tied in urethra.

Catheter removed after twenty-four hours. Wound did not leak. Because of hernia operation the patient did not leave the hospital until April 2. Bladder growing progressively more comfortable.

April 26, 1927. Has passed urine every 4 hours by night until recently. Now once at night. Urine hazy with pus. Patient feels very well.

September, 1927, January and April, 1928. Cystoscopy negative.

Case XV. Pa., male, fifty-four years. Microscopic diagnosis papillary carcinoma of bladder. Intermittent terminal hematuria two months. Urinates every hour. Pus in urine. Bimanual examination and cystogram negative. Cystoscope shows a raspberry-like tumor back of the right ureter with a small slough on it.

September 1, 1925. Ether anesthesia. Suprapubic section. Tumor

clamped, cut away, its pedicle ligatured and 6 steel tubes containing 3 mc. each of radium and attached to silk threads implanted about the base of the tumor. Bladder drained.

Convalescence uneventful. Fistula healed September 22.

October 10, 1925. Urine clear. Urination every hour or two by day but not at night.

December 20, 1925. Cystoscope shows a growth back of right ureter about one-third the size of the original growth. Three platinum seeds containing 3 mc. each implanted through cystoscope.

December 28, 1925. X-ray shows these 3 seeds in place.

Fulgurated twice in January, twice in February, once in March.

May 3, 1926. The ulcer left by the last radium implantation is almost healed.

June 14, 1926. Cystoscope shows the ulcer healed. The right lobe of the prostate is slightly enlarged.

October 18, 1926. Bladder healed but a new small papillary growth has appeared within the prostatic urethra.

This urethral growth was burned once in October, twice in November and once in December.

February 7, 1927. One gold seed containing 1.5 mc. implanted into urethral growth.

The urethral growth was burned again on June 29 and July 6 (specimen again reported papillary carcinoma) and on August 31.

In September, 3 gold seeds containing 1.5 mc. each were again implanted into the urethral growth. This was again burned in December and January but no progress was made until under sacral anesthesia it was well burned once in February and twice in March, 1928. On this last occasion there was only one wee spot of the tumor left in the urethra.[3]

Case XVI. Fra., male, forty-four years. Microscopical diagnosis, papillary carcinoma of bladder. For fifteen months frequent and painful urination with pyuria. Treated at first by silver nitrate through the urethroscope. Subsequently diagnosed as lues of the bladder and treated accordingly but without benefit.

Patient is lean and nervous. Pus in urine. Bimanual examination negative. Cystoscope shows extensive low papillary growth covering an area perhaps 3 by 2 cm. behind the right ureter (with a small

[3] In July urethroscope and cystoscope showed no tumor.

diverticulum above). The left lateral lobe of the prostate is slightly enlarged.

October 24, 1925. Cystoscopic attempt to obtain a specimen from the tumor was unsatisfactory because the soft looking tumor was actually so hard that the cystoscopic forceps could not get any satisfactory bite upon it.

November 1, 1925. Ether anesthesia. Suprapubic section. The

FIG. 10. (CASE XVI.) JUNE 1, 1927

low growing papillary growth involves a band about 3 cm. wide across the fundus and 2 cm. up the right wall of the bladder. It is a roughly triangular affair with the appearance of a fungating mucosa without a great deal of thickening and without any projecting masses: 10 platinum tubes attached to silk threads and each containing 2.5 mc. of radium implanted into the tumor. Bladder drained. Tubes removed after five days.

Post-operative convalescence uneventful. Fistula closed in four weeks. Irritation of bladder continues much the same as before.

March 20, 1926. Urine is grossly clear. Patient is comfortable. Cystoscope shows an inflamed area back of the trigone but no tumor.

September, 1926. Patient reports occasional irritation of bladder and passage of pus and blood since July. He is in good condition. Cystoscope shows low growing papillary growth all over the left side of the trigone and up the fundus on this side. Specimen obtained with difficulty reported carcinoma.

October 11, 1926. Ethylene anesthesia. Suprapubic section. No gross growth seen but small granular looking spots scattered about left side of bladder neck, left lateral wall of bladder and fundus. There is a markedly depressed scar apparently healed at the site of the previous radiation in the midline behind the trigone: 15 gold seeds of 1.5 mc. each implanted. No drainage to bladder.

October 22, 1926. Out of hospital. Holds 4 ounces. The bladder has not leaked. No pain.

January 3, 1927. Back of the diverticulum on right side of fundus a low papillary carcinoma extends in the midline half way from 2 cm. behind trigone to bubble. Left side entirely clear: 5 gold 1.5 mc. seeds implanted by cystoscope.

One week later x-ray showed 4 of these in place.

January 31, 1927. Bladder holds 4 ounces. Urinates every two hours. A hard angular mass can be felt in midline back of trigone.

February 2, 1927. Ethylene anesthesia. Suprapubic section. The mass felt above prostate seems to be an infiltrating carcinoma. The new involvement seen on right side of fundus is also carcinomatous and some extends to the left side as well. Twenty-five gold seeds containing 1 mc. each implanted. The implantation is made several layers deep in the hard mass. Bladder drained.

The result was a severe radium burn. Patient became addicted to pantopon and suffered intensely until September when the hard mass above prostate broke through into the rectum discharging a slough as big as the last joint of the middle finger, containing 4 gold seeds. This relieved much of his pain and the suprapubic fistula then opened (leading around left side of bladder to the point of rectal fistula). Previous to this he had taken two doses of colloidal lead without known benefit. Thereafter he continued to improve, gaining 25 pounds.

May, 1928. Rectal examination reveals an irregular mass above the prostate which is, if anything, smaller than it was six months ago. Pa-

tient is improving constantly in health and getting to the point where he can resume his work. The suprapubic fistula has healed. The rectal fistula is open most of the time. When it is closed, urination is quite painful. By rectal touch it has never been possible to identify the exact site of the fistula.

Case XVII. Po., male, forty-seven years. Microscopic diagnosis, carcinoma of bladder. Hematuria, intermittent eighteen months. Frequent urination one month.

Bimanual examination negative. Cystoscope reveals a sloughing, bleeding, papillary neoplasm over fundus. The urine is purulent and foul smelling.

February, 1924. Ether anesthesia. Suprapubic section. Large tumor, the base of which covers a large section of the right side of the subperitoneal portion of the bladder. Tumor burned away with actual cautery. Radium emanation applied by implantation of eighteen 0.5 glass seeds and 2 steel tubes containing 0.28 mc., the latter left in the bladder for five hours.

The convalescence was prolonged and painful as is usual after glass seed implantation. It was six months before he could hold his urine three hours.

December, 1925. Cystoscopy showed a growth in the vault into which one platinum seed containing 3 mc. was implanted. Ten days later x-ray showed no seed and three days later 2 seeds were implanted. These again could not be found by x-ray examination but on January 6, the tumor was seen to be sloughing as a result of the radium. It was fulgurated twice in January, three times in February, twice in March, one more platinum seed being inserted in January.

April, 2 more platinum seeds. Cystogram negative. Cystoscopy shows small tumor in vault.

April 27, 1926. Spinal anesthesia. Suprapubic section. A growth about the size of a raspberry found in the vault. This was clamped. One gold seed containing 1.5 mc. plunged into its base, the pedicle tied off, the tumor cut away, the bladder sutured without drainage. At the same time a ventral hernia, the result of the first operation, was repaired.

June 15, 1926. Convalescence has been uneventful. Belly wall sound. Cystoscope shows the remains of the tumor in vault and three new small ones below it. Four platinum seeds of 1 mc. each implanted.

September 15, 1926. The tumors have grown. They do not look very malignant. Burned on two occasions.

November 2, 1926. Spinal anesthesia. Suprapubic section. Peritoneum opened and sutured. A small papillary tumor to left of incision was clamped, tied off, cut away, and four 1.5 gold seeds of radium emanation implanted around its base, though this was no more than 0.5 cm. in diameter. Similar but somewhat larger tumors opposite each other at a point about half-way down from the vertex were treated in the same manner, four tubes being put around one and five around the other. Bladder sutured without drainage.

December 24, 1926. Left renal colic, vomiting, fever, leucocytosis. Left kidney large and sensitive.

December 29, 1926. Non-protein nitrogen 56, creatinin 1.7 Diagnosis acute pyonephroses—which subsided in three weeks.

May, 1927. Cystoscope shows ulcerated area about as big as thumb nail in mid-fundus. Some papillary growth about this.

May 6, 1927. Ethylene anesthesia. Resection of bladder. Died six days later. Post-mortem showed gangrenous cystitis; left ureteral atresia; left infected hydronephrosis; ileus due to adhesion of ileum to bladder; carcinoma of bladder; no carcinoma of glands.

CASES OF BLADDER CARCINOMA GROSSLY INFILTRATING AT TIME OF FIRST OPERATION

Case XVIII. Buc., male, fifty-four years. Microscopical diagnosis, carcinoma, clinically infiltrating.

February 1924. Tumor (pathological diagnosis carcinoma) of larynx relieved by radium. In August 1924 frequent and painful urination and hematuria. Cystoscope shows large ulcer to left of bladder neck and general cystitis. Bimanual examination negative.

Refused operation until—

February 18, 1926. Spinal anesthesia. Suprapubic section. Malignant ulceration extending from immediately behind urethra back to well beyond left ureter up lateral wall of bladder to vertex, perhaps 6 or 8 cm. in each diameter. No slough; no projecting tumor into the bladder. Six platinum seeds containing 2.5 mc. each implanted. Bladder sewed without drainage. Left hospital on eleventh day.

Suprapubic wound reopened in fourth week. Symptoms continual. Patient is taking morphine.

August, 1926. Cystogram shows increase in size of tumor.

October, 1926. Died of carcinoma.

Case XIX. Bird, male, forty-four years. Microscopical diagnosis, carcinoma, clinically infiltrating. Frequent urination and terminal hematuria for four months. Has lost 20 pounds.

Non-protein nitrogen 78 mgm., creatinin 3.1 mgm. Urine contains pus. Bimanual examination reveals a hard irregular, movable mass in right side of pelvis reaching from edge of prostate upward about 3 cm. Cystoscope shows a solid looking ulcerating tumor covering right side of trigone but not reaching bladder neck.

February 14, 1928. Spinal anesthesia. Suprapubic section. The base of the bladder was occupied by a carcinomatous ulcer with hard, raised edges. This encroached upon the right side of the trigone and to a lesser degree on the left. The edges were so high and hard that it was impossible to see the trigone around them but one could see a perfectly normal urethral orifice. The right ureteral orifice was involved in tumor and the left one probably. The dimensions of the ulcer were 6 by 3 cm. Thirty gold 1 mc. tubes implanted. These were placed in two layers as some of them sank as much as 2 or 3 cm. before they reached the limit of the hard mass in the bladder wall. Bladder sutured without drainage.

February 22, 1928. Much bladder irritation and diarrhoea. Bladder opened spontaneously.

March 4, 1928. Bladder fistula healed. Urinates every hour with terminal pain. Diarrhoea continues. During convalescence the non-protein nitrogen at one time rose to 78, the creatinin to 3.1.

April 28, 1928. Emaciated. Urinates every hour or two night and day with much pain. Intermittent diarrhoea uncontrolled.

May 8, 1928. Suprapubic wound re-opened. Diarrhoea continues. Patient extremely toxic.

Case XX. St. Jo., male, fifty-six years. Microscopically carcinoma, clinically infiltrating. Lumbar pain and frequency of urination four years. Intermittent hematuria ten months. Has lost over 20 pounds. Is very weak. Hemoglobin 32 per cent, red blood cells 2,900,000. Bimanual examination reveals a large mass in region of bladder. Cystoscope shows large tumor and cystogram shows the asymmetrical bladder.

September 17, 1926. Suprapubic section discloses a papilloma 5 cm. in diameter with a hard base about 3 cm. in diameter growing from the anterior wall of the bladder just above the neck. The base of the tumor was compressed by a cat gut ligature and about two-thirds of it cut away.

Into the remainder fifteen 1.5 mc. gold seeds implanted. Bladder drained.

Although no tonics were given, the hemoglobin rose spontaneously in three weeks to 65 per cent, red blood cells to 4,100,000. The bladder irritation was insignificant. Wound healed October 6. Patient remained very comfortable until March, 1927, when, because of a new bleeding, he applied for a further operation. This was refused because of the palpable size of the tumor. He was operated upon elsewhere and

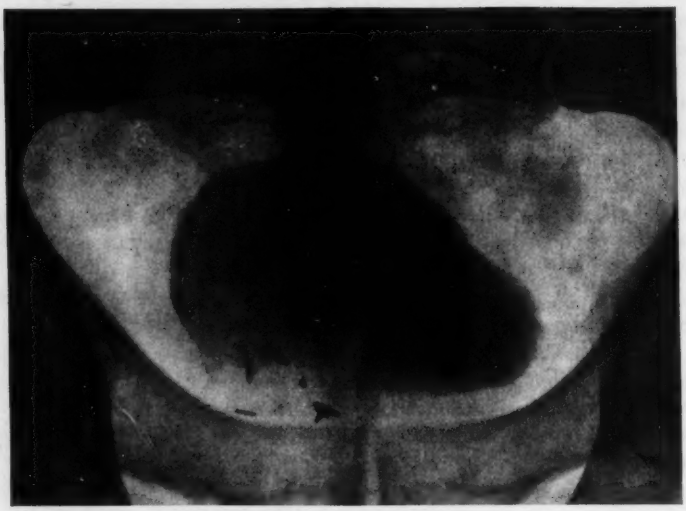

FIG. 11. (CASE XX.) AFTER OPERATION. CYSTOGRAM SHOWS TUMOR STILL PRESENT

reported upon as follows: "The portion of the tumor nearest the top of the bladder was dead; the lower portion of the tumor was living and this I cauterized off and implanted the whole base, which was about 3 by 3 cm., with radium."

Three months later he died of carcinoma.

Case XXI. Scha., male, fifty-nine years. Microscopically infiltrating carcinoma. Frequent urination. Pain in right loin and intermittent hematuria for seven months. Has lost 20 pounds. Non-protein

nitrogen 46 mgm., creatinin 1.6 mgm. Bimanual examination negative. Cystoscope shows neoplasm of the right side of trigone covering ureter.

September 10, 1927. Spinal anesthesia. Patient complained and was restless because of inability to move legs; therefore ether was given. Supra-pubic section. A small papillary tumor with a hard base situated about the right ureteral orifice was clamped, ligatured and five gold tubes of 1.5 mc. each implanted in its base and the tumor cut away. Bladder sutured without drainage. Home on the eleventh day. Bladder did not leak. Convalescence uneventful.

November 14, 1927. Hematuria. Cystoscope shows only a slough 1 cm. in diameter with surrounding oedema at right ureter. The right thigh is still swollen. Rectal examination reveals masses going up right side of pelvis and a mass is felt in the right side of the abdomen.

April, 1928. Patient died of carcinoma.

Case XXII. Te., male, sixty-six years. Clinical diagnosis infiltrating carcinoma. Burning urination four years. Frequent urination and hematuria three months. Has lost 18 pounds. Has had cystoscopic fulguration of bladder tumors in vain. Bimanual examination reveals mass above prostate. Cystogram negative. Urine contains pus. Cystoscope shows that the orifice of the bladder is occupied by a funnel-shaped ulcerating carcinoma which extends over into the trigone. Non-protein nitrogen 100 mgm., creatinin 4.5 mgm.

October 15, 1926. Spinal anesthesia. Suprapubic section. The whole bladder neck and trigone was found infiltrated by an ulcerating new growth. Into this twenty gold seeds containing 1.5 mc. of radium emanation each were planted. Bladder drained.

In a week the blood chemistry had fallen to normal and the bladder fistula was permitted to close. Healed in four weeks.

January 1, 1927. Died of carcinoma.

Case XXIII. Bier, female, fifty years. Microscopically and clinically infiltrating carcinoma; diabetes. Sugar in urine two years (Blood sugar 178). Intermittent hematuria and frequency of urination six months. Has lost no weight during this time. Pus in urine. Bimanual examination reveals mass in pelvis. Cystoscope shows a bleeding papillary tumor back of the trigone.

September 24, 1926. Spinal anesthesia. Suprapubic section. Bladder found invaded by a hard infiltration beginning just to the right of

the median line and extending down the right side of the bladder from its vertex in a band about 2 cm. wide towards the base. Sclerotic perivesical fat adherent. The bladder was accordingly opened to the left of the median line exposing an ulcer about 2 cm. wide and extending from the midtrigone towards the right and posteriorly upwards to the vertex. At the lower end of this ulcer and, as it were, continuing it, some small low masses of papillary carcinoma not much more than 1 cm. high and 2 cm. in circumference. About half of this mass was removed as a specimen by the rongeur forceps. Fifteen gold radium emanation seeds each containing 1.5 mc. were implanted. (The specimen was lost.)

Bladder sutured but broke open the fifth day and healed the twenty-second day. Patient had a good deal of post-operative pain and frequency of urination but whether due to tumor or to radium could not be determined. She took to morphine.

April 14, 1927. Died of carcinoma.

Case XXIV. Da., male, seventy-two years. Pathological diagnosis, carcinoma, clinically infiltrating. Frequent urination and intermittent hematuria five months. Has lost 9 pounds. Urine contains pus. Bimanual examination reveals diffuse hardness of the bladder base above the prostate. Cystoscopy excites much bleeding amid which masses of papillary tumor are seen. Non-protein nitrogen 58.6 mgm., creatinin 2 mgm. Hemoglobin 40 per cent, red blood cells 2,900,000.

November 8, 1927. Spinal anesthesia. Suprapubic section. A tumor was found, the base of which occupied an area some 3 cm. in cross section extending from the edge of the trigone into the fundus a little to the left of the mid-line not involving the right ureter or its mouth but apparently including the right ureteral mouth. The projecting mass in the bladder was low and mushy. It was removed with three bites of the rongeur leaving a hard sclerotic base (which had been palpated by rectum before operation). Twenty gold seeds each containing 1.5 mc. of radium emanation were implanted in the base. Bladder sutured without drainage.

After operation patient had very little bladder irritation. His local comfort and general health improved rapidly though the bladder broke open on fifth day and closed again on the thirteenth. Left hospital on eighteenth day.

January, 1928. His physician writes that though his bladder remains entirely comfortable, the general condition is unsatisfactory and he has

severe pain in the left side of the pelvis, hip and spine, presumably due to metastases, though radiogram does not show any changes in the bones.

Case XXV. De., female, seventy years. Microscopical diagnosis, carcinoma, clinically infiltrating carcinoma of the bladder. Hematuria with clots one year. Marked frequency every few minutes with passage of sand at times during past two months. Loss of weight 30 pounds in past few months. Cystoscope shows severe cystitis, sloughy mass in right fundus and vault covered with phosphates. Bladder decompression gave marked relief for twenty-four hours. Argyrol instillations.

February 21, 1928. (Ten days later.) Cystoscopic examination. The patient's bladder picture has completely changed. The bladder instead of being covered with phosphatic incrustations, now shows the greater part of the bladder mucosa all but normal. The tumor which could not be made out distinctly before is now visible as an infiltrating mass protruding slightly above the surface of the bladder and extending from about the mid-trigone and covering the right uteteral orifice and approximating the bladder neck, extending up to the vault so that the bubble lies against and in front of the upper edge of the infiltrating growth. From this point it extends downward and backward covering much of the right lateral wall of the bladder. A few phosphatic incrustations are adherent.

February 24, 1928. Spinal anesthesia. Suprapubic section. Bladder opened extraperitoneally in mid-line. It was surrounded by adherent fat and somewhat contracted. After the automatic retractor had been placed in position, it was found that the incision in the vault of the bladder went right up to but apparently not into the end of the tumor. Specimen taken and thirty 1 mc. gold seeds of radium emanation implanted in right side of bladder. A large ulcerating tumor with visible papillary outgrowth covered the major part of the right wall of the bladder but did not reach the trigone or bladder neck. The thirty seeds did not seem quite enough.

Inasmuch as some of the tumor was beneath the automatic retractor, it was necessary to replace this by hand retractors. While this was being done a Walker retractor slipped out of the bladder in the mid-line and the whole length of its blade was plunged into the peritoneal cavity. It was immediately withdrawn, no attempt being made to mop out the peritoneum but the hole in it promptly closed.

As the removal of specimen had caused some bleeding, it seemed wiser to drain the bladder. Cigarette to pre-vesical space.

During convalescence the urine was badly infected. Healed 44th day.

May 28, 1928. Cystoscope shows general cystitis. Remaining

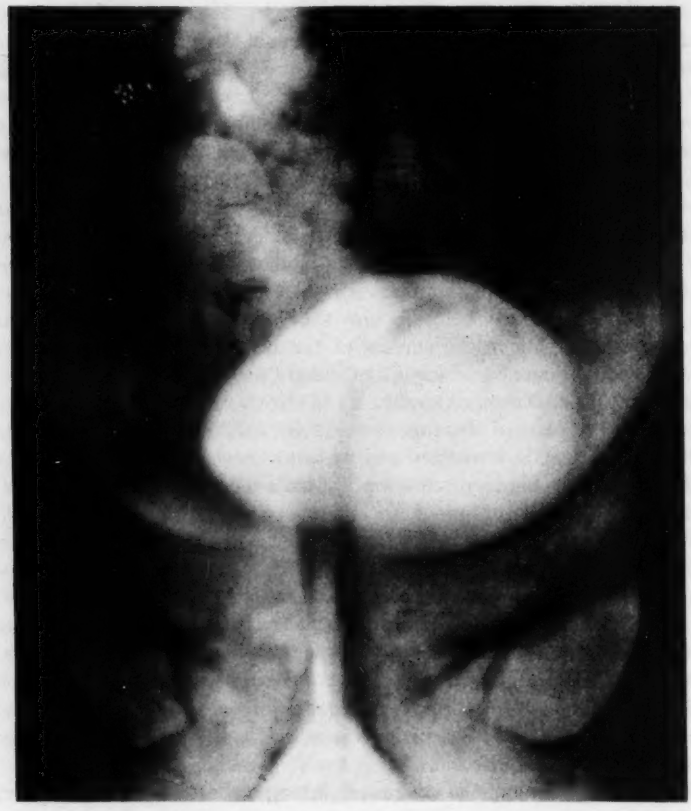

FIG. 12. (CASE XXVI.) AIR CYSTOGRAM AFTER OPERATION. NO BLADDER TUMOR. BLADDER DISLOCATED TO LEFT

ulcerating area extends from 1 cm. back of right ureter mouth up lateral wall to the edge of the bubble. It seems narrow and does not look above 4 cms. long.

May 31, 1928. Cystoscopic implantation of 4 platinum seeds 2.5 mc. each into tumor area.

Case XXVI. Fa., male, sixty-seven years. Pathological diagnosis, carcinoma, clinically infiltrating. Intermittent hematuria three or four years. Constant severe bleeding one month during which he lost 25 pounds. Non-protein nitrogen 55 mgm., creatinin 1.7 mgm., hemoglobin 50 per cent, red blood cells 2,225,000. Pus in urine. Bimanual examination reveals a mass on the right side above the prostate. Cystogram and cystoscopy show an extensive ulcerating tumor of the vault.

January 4, 1927. Spinal anesthesia. Abdominal section. Inasmuch as the pre-operative examination had shown an infiltrated bladder tumor of considerable extent in the sub-peritoneal portion of the bladder, attack was made on this first by opening the peritoneal cavity. Almost all of the wall of the sub-peritoneal portion of the bladder was found infiltrated with carcinoma, but the peritoneum itself was not adherent. The prospect of cure was so slight that it seemed wiser to implant twenty radium emanation seeds (gold, 1 mc. each) into the tumor through the peritoneum and without opening the bladder. This was accordingly done into an area about 6 cm. in diameter at all points in which the infiltration of the bladder wall could be felt. There was a little oozing from the needle punctures. After this had ceased and been carefully mopped up, the peritoneum was closed with plain cat gut, the muscle with chromic, no drainage.

February 8, 1927. Radiogram shows only three radium seeds. The others must have been pushed through the bladder wall and passed out. Bladder continues to bleed. Hemoblobin 35 per cent, red blood cells, 2,600,000. Has lost six pounds more.

February 15, 1927. Ether anesthesia. Suprapubic section. A hard gray ulcer with small phosphatic crystals adherent to it was found to occupy the site of the sub-peritoneal portion of the bladder from trigone to bubble. Thirty 1 mc. gold seeds were implanted into the ulcerating tumor at 1 cm. intervals but did not suffice to radiate very satisfactorily the upper and central portions of the mass (these being omitted because of lack of radium seeds and with the hope that the previous implantation might have covered this region). Bladder sutured without drainage.

Severe post-operative bladder spasms but wound did not break open. He left hospital on fourteenth day.

May 31, 1927. Has regained three pounds. Rarely holds his urine an hour. Discomfort insignificant. No bleeding. Bimanual examination negative.

Hemoglobin 85 per cent, red blood cells 4,600,000. (Has taken no medication.)

November, 1927. Urinates every two hours. No pain. Is within ten pounds of his normal weight. Bimanual examination negative. Cystoscope shows a much inflamed, contracted bladder. There is one flat superficial ulcer in fundus. No tumor seen.

March, 1928. A friend reports him fat and well.

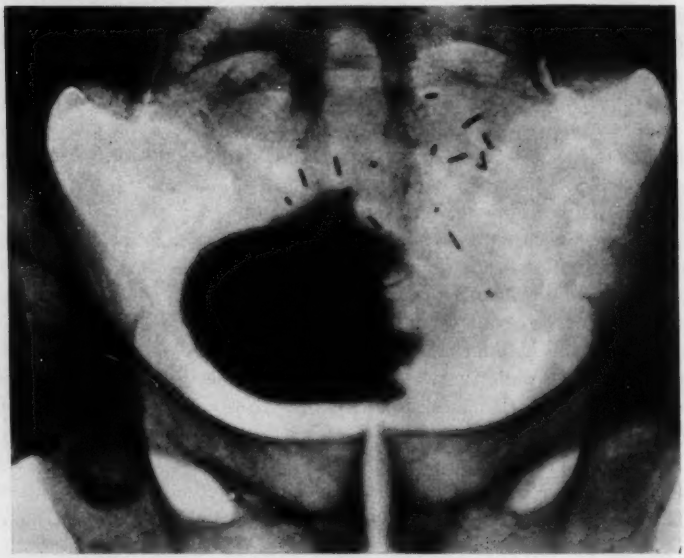

FIG. 13. (CASE XXVII.) AFTER OPERATION. CYSTOGRAM SHOWS TUMOR PROGRESSING, SEEDS MIGRATING

Case XXVII. Fl. male, sixty-four years. Clinically infiltrating carcinoma. For ten weeks painful and frequent urination. Left sacral pain and intermittent hematria. Bimanual examination reveals a large palpable mass above prostate on left side. Cystoscope shows this to be an infiltrating tumor.

February 24, 1927. Spinal anesthesia. Suprapubic cystotomy. Seventeen gold seeds 1 mc. each implanted into a very extensive infiltrating carcinoma of the left side of the bladder extending from the tri-

gone half way to the apex. Bladder suture without drainage. Left hospital at the end of fourteen days. Bladder did not leak.

The operation gave no relief whatsoever.

January 18, 1928. Died of carcinoma.

Case XXVIII. Ga., male, sixty-three years. Microscopically carcinoma, clinically infiltrating. Recent hematuria. Cystoscope shows large tumor right side of bladder. Cystogram shows asymmetry. Bimanual examination reveals a mass above the prostate on the right side.

February 11, 1926. Spinal anesthesia. Suprapubic section. A hard tense tumor about the size of a golf ball was found in the right side of bladder, its equator at the mucous membrane and a considerable amount of tumor beneath this. The base of the tumor ran from the right side of the bladder neck down to the edge of the trigone and was about the size of a twenty-five cent piece. Three radium metal emanation seeds 2.5 mc. each plunged deeply into the tumor. Bladder suture without drainage. Convalescence uneventful. Left hospital on twentieth day.

April 12, 1927. Patient refused to report. Wife writes he is perfectly well but has a slight pain in his knee.

He remained comfortable for about a year but in May 1928 he is reported dying of carcinoma.

The amount of radium implanted was obviously inadequate but gave the patient relief from all his symptoms for over a year.

Case XXIX. Be., male, sixty-seven years. Microscopical diagnosis, papillary carcinoma. Intermittent hematuria two years. Recent acute retention from clots, following a cystoscopy. Bimanual examination reveals a vague resistance and thickening in the bladder region. Cystogram shows the bladder pushed to the left. Cystoscopy very unsatisfactory because of blood. There seems to be an infiltrate all across the base of the bladder. Non-protein nitrogen 65, creatinin 1.5. Hemoglobin 40 per cent, red blood cells 2,500,000. Has lost no weight.

March 18, 1927. Spinal anesthesia. Suprapubic section. An infiltrating tumor was found which when first seen appeared as a papillary growth surrounding the urethra and growing chiefly from the right side of the trigone and the adjacent bladder wall. When an attempt was made to grasp this tumor, however, a portion of the tumor came away in the forceps leaving a cavity surrounded by a hard ridge of infiltrated bladder wall. Its base was about 3 by 3 cm. to the right of and below the

urethral orifice, hid the ureteral orifice to the right side and from this a more recent papillary infiltration of the mucosa extended all the way around the front of the urethra and for about 2 cm. up the right side to the bladder along the line of the ureter. 30 gold seeds each containing 1 mc. of radium emanation were implanted tn this growth, the main

FIG. 14. (CASE XXIX.) AFTER OPERATION

growth being steadied by a finger in the rectum, to identify the depth of the growth which only in one place seemed to need one needle deeper than another. Bladder sutured without drainage.

Temperature after operation rose to 104° and remained about 103° until the bladder broke open on the 6th day. The fistula closed on the twenty-sixth day.

April 25, 1927. Bimanual examination negative except that the

prostate feels sclerotic. Hold urine eight hours. It is cloudy. He feels well.

October 10, 1927. Cystoscopy negative except that right lobe of the prostate seems a little large. Urine contains no pus.

February 15, 1928. Recent hematuria followed by cystoscopy which

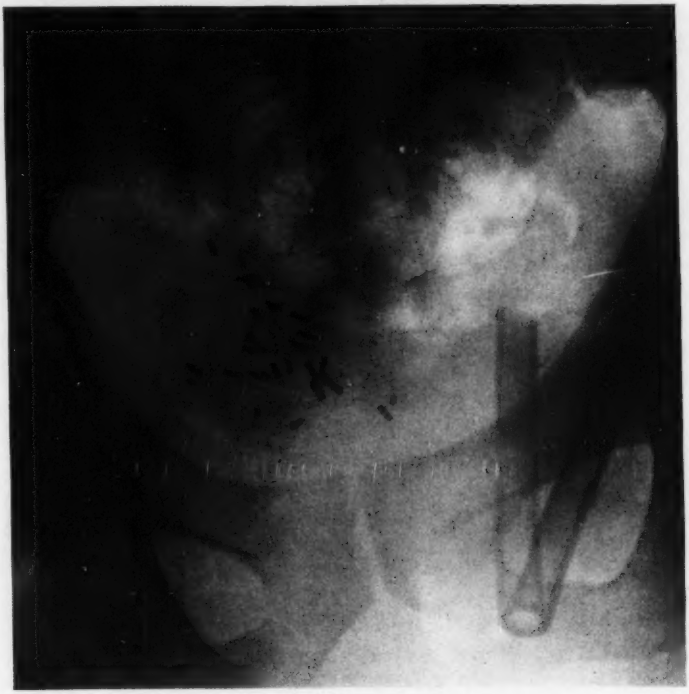

FIG. 15. (CASE XXX.) APRIL 26, 1927

showed behind left ureter the mucosa lifted up and a tumor breaking through it (original tumor was on the right side.)

By cystoscopy 4 platinum seeds of 2.5 mc. each implanted. (Biopsy specimen reported carcinoma.)

March 23, 1928. Cystoscope shows 2 flat, thin, white scars perhaps 1 cm. in diameter. One of them just behind left ureter orifice, the other mesial to this. X-ray shows 3 seeds on left side of bladder.

Case XXX. Bo., male, forty-three years. Microscopical diagnosis, papilloma (!) of bladder; clinical diagnosis infiltrating carcinoma; Wassermann four plus; drinks a quart of whiskey a day. Hematuria during past six months.

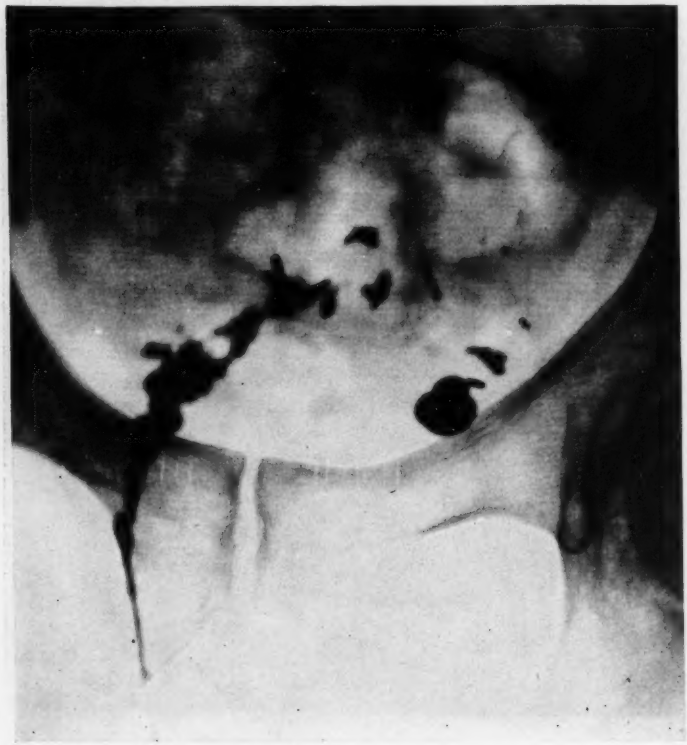

FIG. 16. (CASE XXX.) LIPIODOL IN SINUS. MAY 28, 1928. (REVERSED)

March 1, 1927. Arrived at hospital with retention due to clots. Washed out through litholapaxy tube and immediately refilled. (Under caudal anesthesia). Rectal examination reveals an infiltrating tumor above the prostate on the right hand side of the bladder.

March 2, 1927. Spinal anesthesia. Suprapubic section. Many clots emptied from bladder which was then filled by mistake with alco-

holic solution of picric acid. This was immediately removed by suction. A papillary tumor was discovered to right of bladder neck and along edge of trigone, rectangular in shape, its base 3 by 4 cm., its elevation not more than 1 cm. Indeed the papillae was so small that a specimen was obtained with difficulty. Thirty-two 1 mc. platinum seeds were implanted into the tumor, the base of which was very hard but not more than 1 cm. deep except at its upper edge where it appeared to be somewhat deeper and two layers of seeds were implanted. Pathological report, papilloma.

Convalescence stormy. Though the wound had not been sutured it broke open throughout and did not heal for five months. In the meantime he developed an ischio-rectal abscess on the left side. This was drained March 19. On April 28, he was so weak, anemic and dehydrated that a blood transfusion was given. On May 17 lipiodol injected into ischio-rectal abscess on the left side showed that this ran beneath the bladder to a small cavity on the right side of the pelvis, presumably at a point of pathological bladder rupture where the radium had been implanted. Sinus then healed.

July, 1927. Cystoscope shows a granulating area near the right ureter about 2 cm. in diameter. At this time anti-syphilitic treatment was begun. Urination was painless with intervals about one to two hours.

August 27, 1927. Cystoscope shows granulating area somewhat larger. Specimen taken (reported carcinoma). By rectum one feels a small hard mass above right angle of prostate.

October 25, 1927. Spinal anesthesia. Suprapubic section. A depressed ulcer external to the right ureter mouth about 1.5 cm in diameter with some papillary neoplasm on upper edge. Nine gold seeds of 1.5 mc. each implanted.

The peritoneum was inadvertently opened and one seed was implanted in an infiltrated spot, perhaps part of the old abscess scar, on the right wall of the pelvis. Peritoneum closed. Bladder drained. Fistula healed in sixteen days. Convalescence uneventful until January, 1928, (neoarsphenamine during the interval) when he developed acute cystitis and had two severe bladder hemorrhages requiring evacuation of clots. From this time he could hold his urine but thirty minutes.

March 8, 1928. Suprapubic extravasation of urine opened and later old ischio-rectal abscess re-opened. Fluid introduced through one fistula drained out through the other. From this time the urine remained purulent but he could hold his urine an hour.

April 23, 1928. Passed a large slough per urethram containing several gold seeds.

May 16, 1928. Has gained 10 pounds. Urine is purulent as ever though he washes daily with permanganate. Urination painless. Holds urine three to four hours by day and urinates once at night. Still drinks heavily and has a four plus Wassermann.

Case XXXI. Sm., male, fifty-two years. Pathological diagnosis, carcinoma, clinically infiltrating. In June, 1925, perineal prostatectomy was performed for the relief of hematuria. The bleeding recurred and I first saw him in June, 1926.

June 4, 1926. Prostate scarred. No palpable tumor. Cystoscope shows tumor to right side of bladder neck.

June 4, 1926. Suprapubic section. An infiltrating growth discovered occupying the region about 5 by 3 cm. of the bladder wall, involving the upper right quadrant of the bladder neck and extending upward from this. Six gold tubes of 2 mc. each implanted in this. Bladder sutured without drainage. Did not leak. Home on fourteenth day. Convalescence uneventful.

July 20, 1926. Right epididymitis.

September, 1926. Cystoscope shows 2 or 3 lumps like shoe buttons at the bladder neck near vertex, not ulcerated. From these a trail of low growing papillary tumor extends to the bubble.

September 10, 1926. Ether anesthesia. Suprapubic section. Peritoneum inadvertently opened, explored without finding enlarged glands, sutured. Bladder opened. Seven gold tubes of 1.5 mc. each implanted. Bladder sutured without drainage. Convalescence uneventful. No pain after operation. Left hospital the thirteenth day.

October 8, 1926. Retention from clot last night. Cystoscope shows one lesion about 1.5 cm. in diameter just above bladder neck.

October 15, 1926. Four gold 1 mc. seeds implanted by cystoscope. Thereafter urination every hour for about a month, then every three hours.

January 10, 1927. Cystoscopy negative. Urine free from pus.

February 24, 1927. Incisional hernia. No bladder symptoms. Urine clear. Six months thereafter I hear he is still well. He does not return for observation.

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A STUDY OF EPITHELIAL NEOPLASMS OF THE URINARY BLADDER[1]

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Civiale, in 1842, first advanced the view that benign epithelial tumors of the bladder may become carcinomatous. Numerous conflicting views appeared thereafter in the voluminous literature on the tumors of the bladder. Von Rokitansky believed that all epithelial tumors of the bladder ("zottenkrebs") are malignant. Virchow believed that many are benign. In later writings, there seems to be a gradual trend toward the views of von Rokitansky. Kuster believed that the irritation of a papilloma brings about carcinoma.

Frisch, in 300 cases of tumors of the bladder operated on, found ninety-five to be carcinomatous; 201 were the so-called benign papillomas. Careful histologic investigation, however, showed beginning malignant degeneration in 107.

Among authors who believe in the malignant degeneration of the tumor are Keefe, Watson, Israel, Lehr, Martin, Gardner, Harpster, Buerger, and Egger. More recent writers who hold similar views are MacCallum, Young and Davis, Karsner, Bland-Sutton, and Geraghty.

Christeller stated that everything points to a progressive proliferative process ending in carcinoma. Simon and Fuchs have also noted the metaplasia. The latter reported several illustrative cases. Casper stated that he and others had substantiated the theory of the metaplasia of benign growths of the bladder into malignant growths but added that one must not have been deceived at the first examination.

[1] Abstract of thesis submitted to the faculty of the Graduate School of the University of Minnesota in partial fulfillment of the degree of Master of Science in Urology, 1928.

Rauschenbusch and Lubarsch held that the metaplasia of a benign into a malignant neoplasm had not been proved; Nitze and Sonnenburg have never observed a case of a tumor of the bladder removed at a second operation which showed a different structure from the original. In 150 cases of benign papilloma operated on, he did not find change in the recurrent growth. Birch-Hirschfeld is very skeptical about the transformation. Semon has shown that cases of papilloma of the larynx becoming carcinomatous are rare. In 10,774 cases of papilloma of the larynx, he found evidence of carcinomatous change inconvertible in only five.

Motz, Weinrich, Treplin, Tanton, and Erdman and McCarthy doubted that the transformation occurs. Judd had not observed it in recurring papillomas, although in three instances the removal of a tumor through a suprapubic incision resulted in rapid recurrence in the wall of the abdomen, the nature of the growth being identical with that of the removed tumor. Guyon stated: "The cases which I believe have permitted of this hypothesis of transformation are very exceptional."

Borst believed that a general transition of benign malignant neoplasm does not take place without the previous existence of a high energy for growth, which a favorable opportunity affords. He regarded the difference in the papilloma which remains benign for a very long time and one which rapidly becomes malignant as due to the previously changed biologic quality of the cells in both. In other words, that the papilloma which becomes carcinomatous was carcinomatous from the beginning. Posner, who observed a case of carcinoma of the bladder for eight and one half years agrees with Borst.

Syring reviewed forty-two cases of metaplasia from the literature. These were all he could find which showed the change from papilloma to carcinoma. He said: "I was astonished to find only forty-two cases, and still more that of these forty-two cases very few could critically be called true metaplasia into cancer." His criticism of the individual cases is instructive. He stated further that the dyes, aniline, toluidine, and benzene, can cause carcinoma or papilloma, and that the bilharzic tumor

may be either carcinoma or papilloma. Goebel found fifteen benign bilharzic tumors and thirteen malignant. Syring said: "These facts give me little ground for the argument of metaplasia." In three of his cases the carcinoma which followed the extirpation of the papilloma was in the scar of the abdominal wound. He stated that the papilloma in these cases must be regarded as malignant. Kretschmer, however, stated that not only is the benign papilloma transplanted into the scar but there are cases on record in which the tumors removed were benign and in which the recurrence was malignant. Syring believed that one can speak only with certainty of metaplasia, after he had observed a benign papilloma, unchanged for at least six years, change into carcinoma, microscopically as well as clinically.

Crenshaw stated that a change in the grade of malignancy on recurrence of the growth had not been noted at The Mayo Clinic.

The criterion on which malignancy is based also shows the same remarkable variation which graces most of the observations on these tumors. Albarran made the diagnosis from the type of cell. Orth and Ziegler believed that infiltration of the wall of the bladder and the formation of metastasis were the distinctive signs of carcinoma. Davis decided that infiltration is the desirable test. MacCarty emphasized the cellular diagnosis of carcinoma and his work has made it possible to recognize carcinoma earlier.

Barringer asked five pathologists with regard to their percentage basis for the diagnosis of malignancy. Infiltration was given 100 per cent with variation of 20 to 90 per cent to atypical cells and atypical arrangement of cells.

Kretschmer, MacDonald, Thomas, Kelly, Kolischer and Schmidt, and Braasch believe that cystoscopic examination is usually a sufficient means of distinguishing between benign and malignant tumors of the bladder. Braasch designates certain signs which are useful in distinguishing the benign from the malignant growth. On the other hand, Tenney, Pilcher, Peterkin, and Geraghty emphasize the impossibility of distinguishing between benign and malignant papillomas by cystoscopic examination alone.

As regards the advisability of endovesical removal of a piece of the growth for microscopic diagnosis, opinions again are diametrically opposite. Thomas, Cabot, Young, Herbst and Thompson, Kidd, Corbus, and Deaver are against the practice because of its risks, such as hemorrhage and metastasis.

Bremerman, Moore, Beer, and Crenshaw emphasize the desirability of removing specimens of tumors through the cystoscope for diagnosis. Crenshaw has not seen any bad effects from the procedure. Wood has found that the performing of a biopsy in rats does not increase the incidence of metastasis to the lungs of the Flexner-Jobling rat carcinoma.

There is also some difference of opinion as regards the type of cell found commonly in papillomas or papillary carcinomas. Broders believes that practically all are of the squamous-cell type. Scholl could find only six squamous-cell carcinomas in 333 neoplasms of the bladder. Geraghty found one in his series, Albarran found four, Buerger found five in 113 neoplasms, and Hinman found three. This discrepancy is probably due to the fact that keratinization is usually considered necessary to the diagnosis of squamous-cell epithelioma.

It has long been recognized that carcinomas differ in their effect on the host. Some kill rapidly, others more slowly. Broders groups squamous-cell epitheliomas of the lip into four grades of malignancy. He has also contributed interesting data on neoplasms of the bladder. He said: "A neoplasm can accomplish only what its cells can accomplish; if its cells are active, it is active. A neoplasm may be papillary, firm, and of a low degree of malignancy, or it may be papillary and of a high degree of malignancy. It may be flat or elevated and of a high degree of malignancy; or it may be flat or elevated and of a low degree of malignancy." Again: "We are in the habit of saying that certain benign neoplasms are potentially malignant, when as a matter of fact we have no proof that they are."

Crenshaw stated that the microscopic classification of Broders, although made independently of the cystoscopic data, has since agreed so closely with the cystoscopic picture and terminal results that the method of treatment now depends largely on such grada-

tion. In the few cases in which there has been a difference of opinion as to the grade of malignancy the end results have usually proved that the microscopic diagnosis was correct. Braasch and Bumpus are in agreement with Broders' classification.

With a view to finding out whether there was any change in the histologic future of the secondary tumor, as compared to the original tumor, the histories of cases of tumor of the bladder at The Mayo Clinic in which more than one specimen had been removed were examined. These cases fell into two groups: (1) in which the specimen was removed through the cystoscope as a diagnostic measure and the tumor was removed surgically within a few days, and (2) in which the specimens were from recurrent growths. As a basis for the comparison, Broders' gradation of the squamous-cell epitheliomas was used, principally with a view to finding out whether there had been any increase in malignancy. Arising directly out of this was the reliability of the report of the specimen removed cystoscopically as compared with that of the resected tumor. To establish this, a comparison of the grades of malignancy of the specimens removed cystoscopically with those obtained by resection of the tumor was made. The reliability of the report of a specimen removed cystoscopically and reported inflammatory tissue was investigated by studying the cases in which there were one or more reports of inflammatory tissue and which were proved by subsequent cystoscopic specimens or at operation to be malignant, or undoubtedly clinically malignant.

There were 200 cases in which more than one specimen was obtained. In 170 of these there were two or more positive reports for malignancy. These have been divided into two groups: those in which the specimen was removed as a diagnostic procedure through the cystoscope and from the tumor removed surgically, or during the endovesical treatment of the growth, and those in which the subsequent specimens were from recurrent growths or from tumors not operated on because of inoperability; they were obtained on the patient's return at a much later date.

The cases in which the interval between the removal of the specimens was less than a month fall into the first group. In

the remainder the interval between the first and second specimens was from one to six months, more than six months and less than a year, more than a year and less than two years and more than two years.

If the intervals between three specimens from one patient have been long enough, for instance, two years between the first and second specimens and two years between the second and third, the case has, for the purpose of comparison, been counted twice.

In the first group there were 137 cases. Thirty were graded 1, (according to Broders' classification), forty-two were graded 2, forty were graded 3, and twenty-five were graded 4.

In the second group there were sixty-one cases. There were nineteen in which the interval between specimens was from one to six months; of these five were graded 1, six graded 2, six graded 3, and two graded 4. There were sixteen in which the interval was from six months to one year; of these one was graded 1, five were graded two, nine were graded 3 and one was graded 4. There were fourteen in which the interval was from one to two years; of these seven were graded 1, four graded 2, and three graded 4. There were twelve in which the interval was more than two years; of these two were graded 1, five graded 2, three graded 3 and two graded 4. The greatest interval between specimens graded 1 was three years and eight months, graded 2, nine and a half years, graded 3, twelve years and five months, and graded 4, four years. In none of these cases was there any variation in the grade of malignancy. The type of growth has remained the same in each case. In the second group the specimens were practically all from recurrences of the malignancy.

In two cases (not included among the sixty-one cases already discussed), there was a definite increase in the grade of malignancy in subsequent specimens removed.

In the first case the initial report was squamous-cell epithelioma, graded 1, situated in the right base and wall of the bladder. The patient returned five months later with recurrent growths described as multiple and "meaty" in the right base and left wall. Biopsy was not done at this time. Two years and three months after the first visit, biopsy showed squamous-cell

epithelioma, graded 3, on the right side of the trigone. The patient died a year and four months later. The important question is whether the later growth was an entirely new growth or a more malignant recurrence of the initial growth. The primary and secondary growths were multiple and the final growth was single. In this connection the influence of radium on a growth with reference to the degree of malignancy should be considered. To decide absolutely whether there had been re-

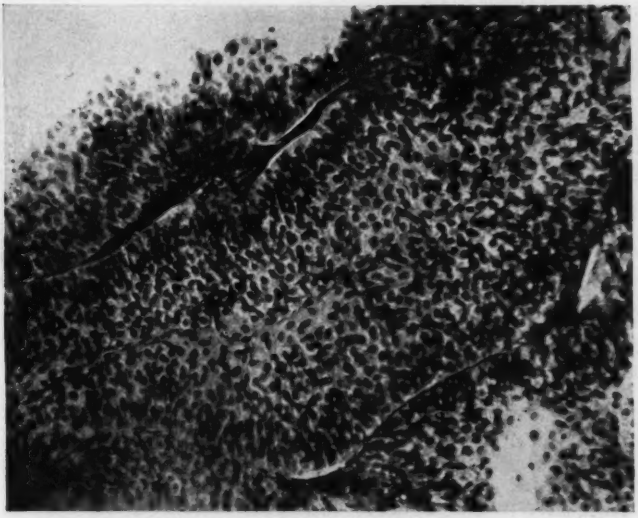

FIG. 1. SQUAMOUS-CELL EPITHELIOMA, GRADED 1 (×100)

currence from the original growth or whether the growth was independent, is obviously impossible (figs. 1 and 2).

Martin has never observed a case of cure by roentgen-ray, and he reported a case in which the growth was apparently accelerated by deep roentgen-ray exposure. Kidd noted that if radium failed to kill the deep cells it may stimulate them into more active growth. Wood stated that it is a matter of clinical observation that after a tumor has been favorably influenced by irradiation and then recurs, the recurrence is less sensitive to irradiation.

In the second case there was increase of malignancy from grade 2 to grade 3 in five years and nine months. The patient had been free of symptoms for four years and nine months after the first operation before the recurrence. The secondary tumors were in practically the same situation in the bladder. Again the question arises of whether the subsequent growths in this case were recurrent or independent tumors. The fairly long period of four years and nine months of freedom from symptoms points to the

FIG. 2. SQUAMOUS-CELL EPITHELIOMA, GRADED 3 (SAME CASE AS THAT SHOWN IN FIGURE 1 TWO YEARS AND THREE MONTHS LATER) (×100)

possibility, at least, of the subsequent growths being independent and new. On the other hand, the secondary tumors were in about the same area as the first. In this case, radium was not employed in the interval between the first and the subsequent growths (figs. 3 and 4).

In investigating the reliability of the report on the specimen removed cystoscopically, 129 cases were examined in which malignancy had been reported and subsequent microscopic ex-

amination of the resected tumor made. These 129 cases were divided according to the grade of malignancy. Twenty-seven were graded 1, thirty-nine were graded 2, thirty-nine were graded 3, and twenty-four were graded 4. In each case the grade of malignancy determined by the examination of the cystoscopic specimen agreed with that of the resected tumor, showing conclusively the reliability of the first positive report on the specimen removed cystoscopically.

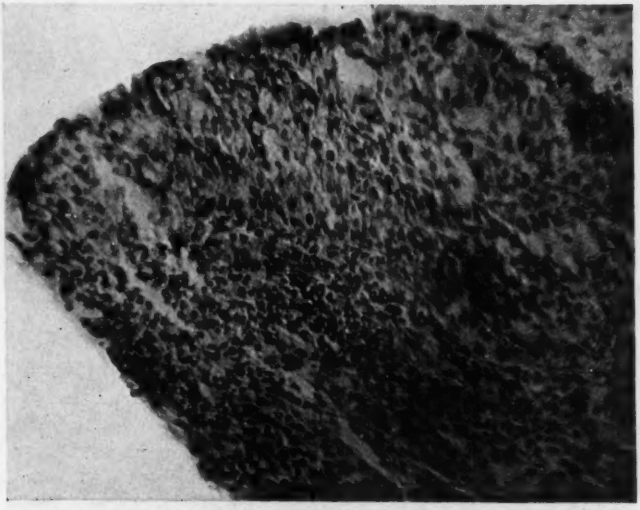

FIG. 3. SQUAMOUS-CELL EPITHELIOMA, GRADED 2 (×100)

In thirty cases (not included in the 129 cases), the first specimen removed cystoscopically was reported to be inflammatory and later cystoscopically or surgically removed specimens were reported to be malignant. In the group in which the growth was proved malignant by subsequent cystoscopic examination there were thirteen cases, three of which were graded 1, seven graded 3, and three graded 4. In two cases, graded 1, there were two specimens removed before the cystoscopic specimen was reported malignant, and in one case, graded 4, there were two specimens

removed before the third specimen was reported malignant. There were seventeen cases in the group proved malignant only by surgical intervention; of these two were graded 2, five graded 3, and ten graded 4. In two cases graded 3 and in two cases graded 4, two cystoscopic specimens were reported inflammatory before the diagnosis of malignancy was established by the surgical removal of the growth. Combining these two groups the grading was as follows: three (10 per cent) were graded 1, two

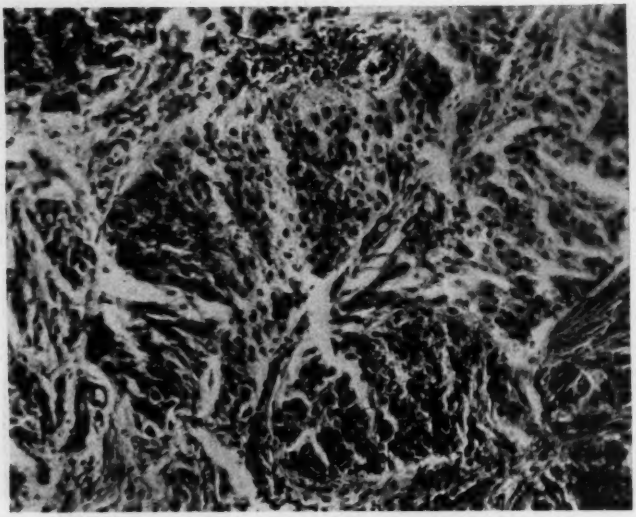

FIG. 4. SQUAMOUS-CELL EPITHELIOMA, GRADED 3 (SAME CASE AS THAT SHOWN IN FIGURE 3 FIVE YEARS AND NINE MONTHS LATER) (×100)

(6.66 per cent) were graded 2, twelve (40 per cent) were graded 3, and thirteen (43.33 per cent) were graded 4. Thus, 16.66 per cent of the cases were graded 1 and 2, and 83.33 per cent were graded 3 and 4. This is accounted for by the fact that the more highly malignant growths are frequently of the flat sessile type, and removal of a specimen through the cystoscope is difficult. Also, in the higher grades of malignancy, there is often greater inflammatory reaction which increases the likelihood of obtain-

ing inflammatory mucous membrane instead of the growth in the specimen, and because cystitis increases the irritability of the patient, rendering cystoscopic examination more difficult.

In six cases, cystoscopically and clinically diagnosed carcinoma of the bladder and classified as inoperable, the cystoscopically removed specimen was reported inflammatory. In five of these cases in which the diagnosis by the subsequent history seems to have been justified, only one specimen was removed in each case. In the sixth case three specimens were reported inflammatory but the subsequent history of the patient throws grave doubt on the correctness of the diagnosis of carcinoma of the bladder. A brief history of this patient follows.

A man, aged sixty-two, registered in The Mayo Clinic May 31, 1921, complaining of pain and urgency of urination. He had noticed the frequency for seven or eight months, the dysuria for four or five months, and slight hematuria for three months. The cystoscopic report was a sessile, meaty growth on the left base and left and posterior walls. A specimen was reported to be inflammatory. Specimens removed June 9 and October 25 were also reported inflammatory. Lavage of the bladder was the only treatment carried out. To a letter of inquiry, January 9, 1926, the patient answered that he was well and had not been troubled with hematuria since his visit to the clinic.

In estimating the value of the cystoscopically removed specimen which is reported inflammatory when the bladder is suspected of harboring malignancy, there are several striking points. One or even two reports of inflammatory tissue are never sufficient to warrant the exclusion of malignancy, particularly as the report of inflammatory tissue, as pointed out, is far more common in the highly malignant and more dangerous types of growth; the striking feature is the surprisingly small number of cases in which the diagnosis was not made from the cystoscopically removed specimen. Of these, there were two specimens removed which were reported inflammatory in only four cases. In the remaining thirteen only one specimen was removed in each case. With a view to ascertaining whether there were any variations in the grade of malignancy in different parts of the same tumor,

sixty-four tumors were examined microscopically. Sections were made from the surface, from the base, and from the juncture of the mucous membrane and the tumor in fifty-eight of these. In five, two sections, either from the surface and from the base, or from the surface and from the juncture of the mucous membrane and the tumor, were made. In one hemisection was made. In two cases, two separate specimens were taken in the specified areas from each tumor. In three of the cases two tumors from each bladder were examined, in the areas mentioned; in one case both tumors were graded 1, and in the other two cases both tumors were graded 2.

In all of these cases the sections were graded independently. Eleven tumors were graded 1, twenty-two were graded 2, nineteen were graded 3, and twelve were graded 4. In none of the cases was there any difference in the grade of malignancy in the different areas. As the specimen removed cystoscopically is practically always from the surface, the importance of this observation is apparent.

SUMMARY

In sixty-three cases in which the subsequent specimen was from a recurrent growth the grade of malignancy was increased in two. In these two, there is some doubt as to whether the second tumor was recurrent or an entirely new growth. In the the sixty-one cases which did not show variation, thirty-five were graded 1 and 2.

In 119 cases the reliability of the positive report of malignancy of the cystoscopically removed specimen was established. The appraisement of the value of the report of inflammatory tissue in the cystoscopically removed specimen was brought out in thirty-six cases. The fact that the malignancy of squamous-cell epithelioma does not vary in different areas of the same tumor was established in sixty-four cases.

In this series there were sixty-one cases, practically all of recurrence, in which malignancy had not increased. Cases graded 3 or 4 should probably not be considered in the estimation since they are so highly malignant as to leave little room for

increase. This leaves thirty-five cases graded 1 or 2 without an increase in malignancy. The cases graded 2 are undoubtedly epitheliomas. Metastasis is common. The fifteen cases graded 1 comprise the so-called benign papillomas recorded in the literature. The recurrent growths had not increased in malignancy. In the two cases in which malignancy had increased, the original grading was 1 and 2. There was thus one of the so-called benign papillomas that showed a definite increase in malignancy in recurrence, a percentage of 6.25.

The deduction to be drawn from these cases is that, with possibly a few exceptions, a growth retains its grade of malignancy, that is, the squamous-cell epithelioma, the so-called benign papilloma, remains in the same stage of malignancy or non-malignancy.

CONCLUSIONS

1. The so-called benign papilloma should be classified as epithelioma of low grade malignancy.
2. With few exceptions, malignancy does not increase with recurrence.
3. The grading of a specimen removed cystoscopically can be relied on.
4. The specimen reported to be inflammatory tissue should be examined several times before exclusion of malignancy is justifiable.
5. Epithelioma of the bladder does not show variation in grade of malignancy in different parts of the same tumor.

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MALIGNANT DISEASE IN DIVERTICULA OF THE BLADDER

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Diverticula of the bladder in association with primary malignant disease of the bladder and invasion of diverticula by the lesion have often been observed, but primary malignant disease in a diverticulum in the absence of involvement of the bladder is not common. Targett, in 1896, found seven specimens in four museums in which diverticula and malignant disease of the bladder were associated. In four of the specimens the malignant disease in the bladder had invaded the diverticula extensively. In the remaining three cases it was believed that the malignant disease was primary in the diverticula. Further review of these, however, seems to show that only one of the cases (case 4) was an undoubted instance of primary epithelioma of a diverticulum without involvement of the bladder. In Targett's case 5 the diverticulum contained what he believed was an innocent papilloma. In case 6 the diverticulum contained a tumor described as sarcoma which, according to the author, is probably incorrect. Young, in 1909, reported a small carcinoma about 2 cm. in diameter confined to a diverticulum; resection of the diverticulum resulted in complete cure. Judd and Scholl reported the association of carcinoma of the bladder and of the diverticula in ten cases, in four of which the carcinoma occurred primarily in the diverticula, but in a recent review of these cases, I am led to believe there was secondary involvement of the bladder immediately adjacent to the communicating orifice in all except one case in which the malignant disease was confined to the diverticulum. Thomas, Harris and Buerger, have each reported a case in which the lesion apparently was primary in and confined to a diverticulum. Demming recently reported

in full a case of carcinoma confined to a diverticulum. Hinman and others have presented extensive reviews of large series of cases of diverticula of the bladder; little literature is to be found, however, on the incidence of malignant lesions in diverticula.

During the last three years I have operated in four cases in which the primary epithelioma was confined to a diverticulum. These cases, with a case (case 1) operated on by Judd in 1916, will be reported in the following series:

FIG. 1. DIVERTICULUM OPENED AND SHOWING EPITHELIOMA (GRADED 2) CONFINED TO THE DIVERTICULUM

REPORT OF CASES

Case 1. A man, aged sixty-two, came to the Mayo Clinic on account of hematuria which had been intermittent for the last two years, with some frequency.

Many red blood cells and pus cells were found in the urine. On cystoscopic examination a tumor was seen protruding from the opening of a diverticulum in the right wall of the bladder. A specimen was removed which showed it to be epithelioma (graded 2). At operation a papillary epithelioma was found almost to fill a diverticulum, and protrude through the opening of the diverticulum into the bladder, but the diverticulum only was involved. The mucosa of the bladder was

free. The diverticulum was entirely excised (fig. 1). Six months later symptoms of recurrence in the bladder were manifest. The patient died a year after the operation.

Case 2. A man, aged fifty-nine came to the clinic November 25, 1925, on account of difficulty in voiding, and frequency and inability

FIG. 2. BLADDER AND DIVERTICULUM INTACT WITH RIGHT URETER ENTERING THE DIVERTICULUM

Two areas of epithelioma 2 cm. and 1 cm. respectively in diameter (graded 4) are shown just below right ureteral orifice.

to empty the bladder. For several months he had noticed a variable-sized mass in the right lower part of the abdomen. The urine had been cloudy for months, but was clearer at times. He had lost 20 pounds in the preceding six months.

A large soft cystic mass, believed to be a hugely distended bladder, filled the lower half of the abdomen. The systolic blood pressure was

116, the diastolic 80. A twelve-hour specimen of 1200 cc. of urine contained many blood cells and a great deal of pus. The Wassermann reaction on the blood was negative. The blood urea was 62 mgm. for each 100 cc. The hemoglobin was 46 per cent; the erythrocytes numbered 3,020,000 and the leukocytes 10,300. Roentgenologic examination of the kidneys, ureters, and bladder was negative. The patient was sent to the hospital and measures for decompression of the bladder were instituted. After two weeks of permanent urethral drainage the blood urea dropped to 36 mgm. A cystogram at this time showed a huge diverticulum of the bladder. The patient's general condition was poor, and after three weeks in the hospital, when the blood urea had gone as high as 122, it seemed advisable to institute suprapubic drainage. This was done December 21, under local anesthesia. The patient failed to improve, became progressively worse, and died six days later.

At necropsy a large diverticulum was found emptying into the right wall of the bladder. The diverticulum in its contracted state was as large as the bladder; judging from the size of the abdominal mass and the cystographic data it must have been at least twice the size of the bladder previous to drainage. It was relatively thin-walled in comparison to the bladder and its walls did not contain muscle fibers. A large foramen, fully 2 cm. in diameter, communicated between the diverticulum and the bladder. The right ureter, which was double, united at the bladder, entered the diverticulum, and a true interureteric bar extended from one ureteral orifice in the diverticulum, through the foramen of communication to the left ureteral orifice in the bladder (fig. 2). The wall of the bladder was greatly hypertrophied. In the lateral wall of the diverticulum, below the right ureteral orifice, were two flat, malignant-appearing lesions, one about 2 cm. and the other about 1 cm. in diameter; on microscopic examination these proved to be squamous-cell epithelioma (graded 4). The double ureter on the right led to a double kidney. Both ureters were dilated, and the upper half of the kidney was destroyed. The true bladder did not contain epithelioma; the epithelioma was confined entirely to the diverticulum, and was situated several centimeters from the foramen of communication between the diverticulum and bladder. In other words, this is an instance of primary epithelioma in a diverticulum. The patient died from bronchopneumonia.

Case 3. A man, aged fifty-five, came to the clinic March 1, 1926, on account of epigastric distress.

The patient appeared healthy and robust, weighing 194 pounds (88.2 kgm.). The general examination was negative. The finding of many blood and pus cells in the urine prompted investigation of the urinary tract. The blood urea was 18 mgm. for each 100 cc., the phenolsulphonephthalein output was normal. A roentgenogram of the kidneys, ureters and bladder was negative. There was only 60 cc. of residual urine on several examinations. Cystoscopic examination

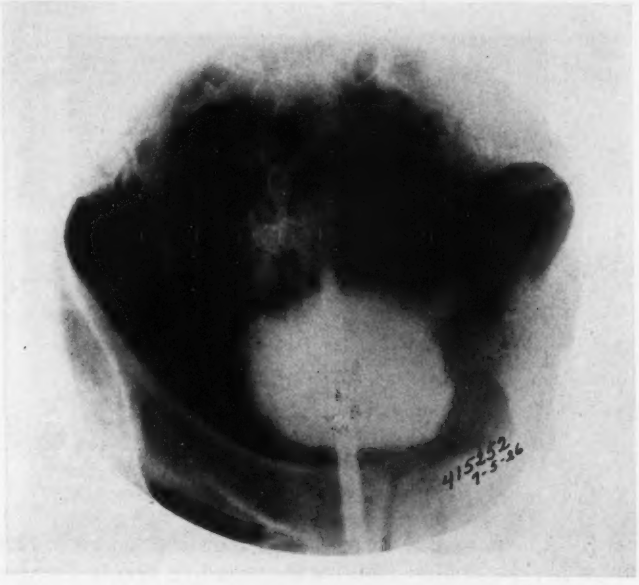

FIG. 3. DIVERTICULA OF THE BLADDER

disclosed moderate cystitis, an opening 2 by 1 cm. in the right wall of the bladder and another 1 by 1 cm. in the left wall; a diverticulum of the right base of the bladder 6 by 7 cm. in diameter and one of the left base 4 by 4 cm. in diameter (fig. 3). On the basis of a slight filling defect in the diverticulum of the right base the clinical consultant suggested the possibility of a neoplasm in the diverticulum.

March 13, 1926, extravesical excision of the diverticulum of the right base, and transvesical excision of the left diverticulum was performed.

The diverticulum on the right side was densely adherent, and because the right ureter emptied into the bladder at the orifice of the diverticulum it was divided and subsequently reimplanted into the bladder. The diverticulum on the right was about 4 cm. in diameter and contained a primary malignant papilloma 2 cm. in diameter (graded 2) entirely confined within the diverticulum (fig. 4). The mucous membrane of the bladder was entirely free of tumor. Cystoscopic examination four months later did not show evidence of malignancy in the bladder.

FIG. 4. DIVERTICULUM: EPITHELIOMA (GRADED 2)

Case 4. A man, aged seventy, case to the clinic August 9, 1926, on account of bladder trouble. During the preceding twenty-five years he had experienced frequency, difficulty, and inability entirely to empty the bladder.

A huge cystic mass filled the lower part of the abdomen, and extended to the level of the umbilicus. Digital examination did not reveal enlargement of the prostate. In a single specimen of urine consisting of 1200 cc. the specific gravity was 1.014; a slight trace of albumin and only a few pus cells were present. The blood urea was 34 mgm. for each 100 cc. A roentgenogram of the kidneys, ureters and bladder was negative. The patient did not remain for further investigation at this time, but returned to the clinic June 25, 1927. He was sent immediately to the hospital where gradual decompression was instituted.

The blood urea at this time was 30 mgm. for each 100 cc. A week later a cystogram showed that the outline of the bladder was about normal size and pushed well to the left of the median line by a huge diverticulum which contained more than 1000 cc. of medium. There was a small calculus in the bottom of the diverticulum.

Suprapubic drainage of the diverticulum and bladder was instituted twelve days after admission to the hospital. This was maintained for about a month, when extravesical excision of the diverticulum was

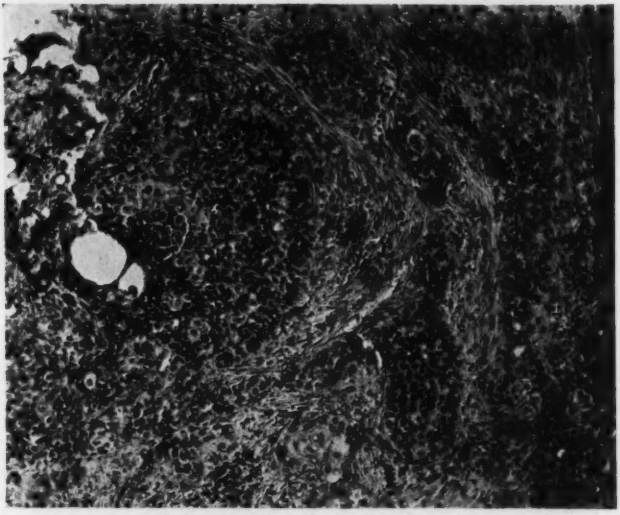

FIG. 5. (CASE 4.) SECTION OF EPITHELIOMA (GRADED 4) CONTAINED IN DIVERTICULUM

carried out. The capacity of the diverticulum was about 1 liter. On removal of the diverticulum a squamous-cell epithelioma 3 by 2 by 1.5 cm. (graded 4) was found in its lateral wall well away from the orifice of communication between the diverticulum and bladder and confined entirely to the diverticulum (fig. 5). Convalescence was satisfactory until the fifteenth day when an attack of pulmonary embolism occurred, from which death resulted six days later, twenty days after operation.

Necropsy showed that the bladder was practically healed and the operative field clean. There was a large infarct of the right lung

secondary to a pulmonary embolus from the left internal iliac. Careful examination of the bladder did not disclose evidence of malignant disease. This likewise is a case of primary epithelioma of a diverticulum of the bladder.

Case 5. A man, aged fifty-five, came to the clinic April 6, 1928, on account of hypertension with a sensation of fullness in the head, dizzi-

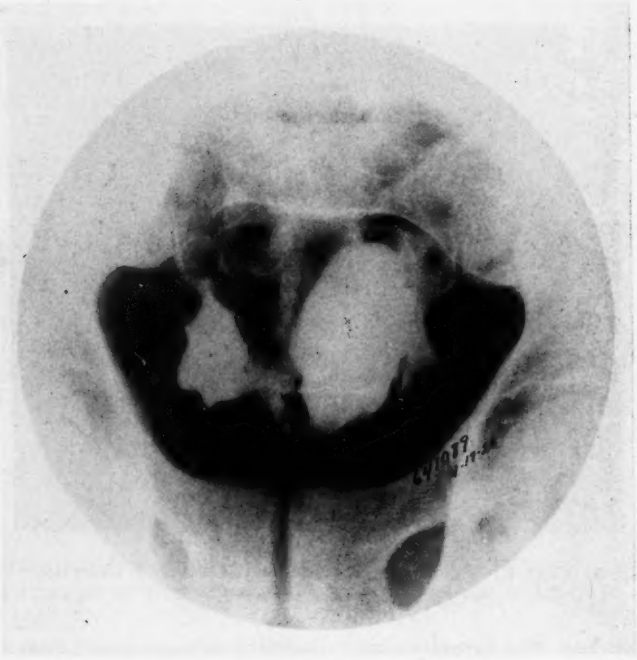

FIG. 6. (CASE 5.) HUGE DIVERTICULUM OF THE LEFT WALL OF THE BLADDER

ness, and so forth. Urinary symptoms were not apparent, but the presence of nocturia during the last year was elicited. A slow stream, and acute retention appeared four days before examination, with much frequency and with burning on urination.

The systolic blood pressure was 190 and the diastolic 124. General

examination disclosed little of importance except moderate fullness in the lower part of the abdomen, suggesting distended bladder. The urine contained a few red blood cells and many pus cells. A roentgenogram of the kidneys, ureters and bladder was negative. The hemoglobin was 80 per cent. Erythrocytes numbered 4,700,000 and leuko-

FIG. 7. (CASE 5.) EXCISED DIVERTICULUM IN WHICH THERE WAS AN EPITHELIOMA (GRADED 3) ABOUT 1 CM. IN DIAMETER

cytes 10,600. The primary estimation of the blood urea was 38 mgm. The first estimation of residual urine was about 150 cc. Slight enlargement of the prostate was noted on digital examination. The patient was sent to the hospital and permanent urethral catheter introduced for the purpose of gradual decompression of the bladder. After drainage

for several days the catheter was removed and cystoscopic examination showed slight intravesical enlargement of the median lobe of the prostate. There was much trabeculation of the bladder and diffuse cystitis of moderate degree. A true diverticulum could not be demonstrated but there were a number of cellules. Neither ureteral meatus was seen. In several subsequent determinations of residual urine the amount varied from 300 to 1200 cc. A subsequent cystogram showed a very irregular outline of the bladder with a large diverticulum in the left base larger than the bladder (fig. 6). A third cystogram showed

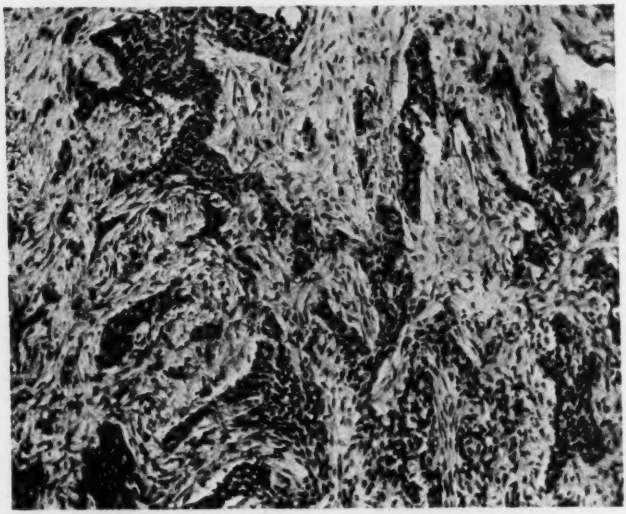

FIG. 8. (CASE 5.) SECTION OF THE EPITHELIOMA FROM THE DIVERTICULUM

the medium retained in the diverticulum, together with residual medium in the right base which was thought to be in the bladder. Permanent urethral catheter was maintained for fourteen days during which time the blood urea was reduced to 14 mgm. for each 100 cc., the phenolsulphonephthalein output was normal in two hours. The patient's general condition was excellent.

April 21, under sacral anesthesia and abdominal wall block, the bladder was explored. The wall was greatly thickened, and there was

extensive trabeculation. In the left lateral wall, well above the ureteral orifice, an opening about 1.5 cm. in diameter led into a diverticulum with capacity larger than that of the bladder. There were two additional diverticula of the base of the bladder with their openings just lateral to the ureteral orifices. These diverticula were of about equal size and were about 7.5 cm. in diameter. The prostate was slightly enlarged intravesically, and a moderate degree of cystitis was present. Extravesical excision of the large diverticulum of the left lateral wall was readily accomplished. The diverticulum measured 12.5 cm. in diameter (fig. 7).

Examination of the diverticulum disclosed a sessile tumor about 1 cm. in diameter situated well out in the lateral wall of the diverticulum. On microscopic examination this proved to be an epithelioma (graded 3) (fig. 8). Transvesical excision (after the method of Geraghty) of the diverticulum of the left base of the bladder was made. Excision of the diverticulum of the right base seemed inadvisable at this time; careful inspection of the interior of the diverticulum, however, disclosed a perfectly smooth lining without evidence of tumor. Epithelioma was not present in the wall of the bladder or in the eight diverticula of the base. I have every reason to believe that the epithelioma found in the large diverticulum of the left lateral wall was a true primary lesion. Suprapubic drainage was instituted with the idea of removing the diverticulum later. The patient's convalescence has been uneventful.

DISCUSSION

Although the diagnosis of diverticula of the bladder is being made very accurately, the preoperative diagnosis of tumors confined to diverticula is exceedingly difficult and usually is not made unless the tumor projects into the bladder, as in case 1. A filling defect in the diverticulum, as observed in the cystogram, may suggest the possibility of a neoplasm, as in case 3. The various types of tumors that occur in the urinary bladder may be found in diverticula; however, in each of the cases reported here the lesion was an epithelioma, varying in degree of malignancy, according to Broders' classification but in most instances graded high. A number of cases have been observed at the clinic in which there was involvement of the bladder and diverticulum, and it was difficult to determine the primary site of the lesion,

but since it seems reasonable to assume in most instances that the lesion was primary in the bladder they have not been included in this series.

The methods of surgical extirpation of diverticula of the bladder are usually applicable even if malignancy is present. It would seem that the results of extirpation of the diverticulum and the growth in the absence of external extension should be productive of better results so far as cure is concerned than is obtained in primary malignant disease of the bladder. I believe that extravesical extirpation of large diverticula containing malignant neoplasms facilitates complete removal of growths with minimal risk of transplanting malignant tissue.

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SARCOMA OF THE BLADDER

REPORT OF A CASE

ROBERT C. BRYAN

A. B. K., forty-two, male, farmer.

Chief complaint. Increased frequency of micturition with dysuria, hematuria, nocturia, and severe tenesmus. Amount of fluid output has decreased.

Present illness. Trouble first began three or four years ago, and was treated by doctor; condition became better and had no trouble until last September. Had to stop work on account of urinary condition, and for the last six weeks patient has been in bed. In hospital in Raleigh, N. C., for last week.

Family history. Mother and father living and well. Two sisters and six brothers living and well. No history of Tuberculosis, cancer, diabetes or specific infection.

Past medical history. Some of childhood diseases, otherwise very healthy all of life except trouble with bladder.

Past surgical history. Negative.

Gastro-intestinal. Poor appetite, no nausea or vomiting, slight constipation. No pain or history of ulcer.

Cardio-respiratory. No dyspnea, no cough, no edema, no night sweats, no palpitation of heart. No dizziness, no headache.

Genito-urinary. Dysuria, hematuria, polyuria, nocturia, tenesmus, amount of fluid output decreased. No pain over kidneys.

Marital. Wife living and well. Two boys living and well, one daughter living and well.

General appearance. Male, well developed, not emaciated, actions normal, skin moist, hair normal, slightly obese.

Head. Contour good, facial muscles negative, no scars. Eyes, react to light and accommodation. Ears, negative. Nose, negative. Throat, slightly inflammed, mucus membrane normal. Teeth, poor, cavities present.

Neck. No torti collis, cervical, axillary and inguinal glands negative.

Chest. Well developed, symmetrical in development, expansion,

good percussion. Heart, no murmur, regular in rate and rhythm, strong. Lungs, no râles, breath sounds clear and vesicular.

Abdomen. Left inguinal hernia. Liver and spleen negative. Abdomen firm, no masses or tenderness.

Extremities. Reflexes negative, extremities negative.

Blood pressure. 130/80.

Impressions. (1) Cystitis. (2) Nephritis. (3) Malignancy. (4) Tuberculosis. (5) Ulcers secondary to primary infection.

Laboratory reports. December 19, 1927. Urinalysis: Red, very cloudy, alkaline, Specific gravity, quantity not sufficient, albumin slight trace, sugar negative. Sediment: 4 plus pus and blood (uncentrifuged) some mucus.

Blood report. Hemoglobin 80 per cent; Tall, red blood cells 4,280,000; white blood cells 4800. Large mononuclear 1 per cent; lymphocyte 11 per cent; neutrophile 88 per cent.

Blood non-protein nitrogen 120 mgm. per 100 cc. Blood urea 90 mgm. per 100 cc. Creatin 10 mgm. per 100 cc.

December 20, 1927 Wassermann negative.

December 21, 1927. Urinalysis: Brown, cloudy, alkaline; Specific gravity 1020; albumin slight trace; sugar negative. Sediment: 4 plus blood, abundant pus.

December 22, 1927. Blood report: Large mononuclear 2 per cent; neutrophile 92 per cent; lymphocyte 4 per cent; myelocyte 2 per cent. White blood cells 10,200.

December 23, 1927. Blood non-protein nitrogen 226 mgm. per 100 cc. Blood urea 168 mgm. per 100 cc. Creatin 13 mgm. per 100 cc.

Cystoscopic examination, December 20, 1927. Patient is taken to the cystoscopic room, novocaine, 0.5 per cent, is injected in the urethra and the No. 24 French cystoscope is introduced with considerable difficulty, it being noted that the beak of the instrument rides over some very firm structure; the distinct, gristly, hard feel of this structure being significant of a malignancy of the prostate. Since this introduction was so unusual and attended by extraordinary conditions the instrument was removed, the same phenomenon arising on its introduction again. It required frequent and continued irrigations of the bladder to control the hemorrhage which, although not great, was sufficiently annoying to obscure the field for a satisfactory visualization. A continuous stream was allowed to run in so that glimpses now and then were obtained, which were, however, only partially satisfactory. One could see on the left of the field coming into view, a distinct, finger-like, firm, hard sym-

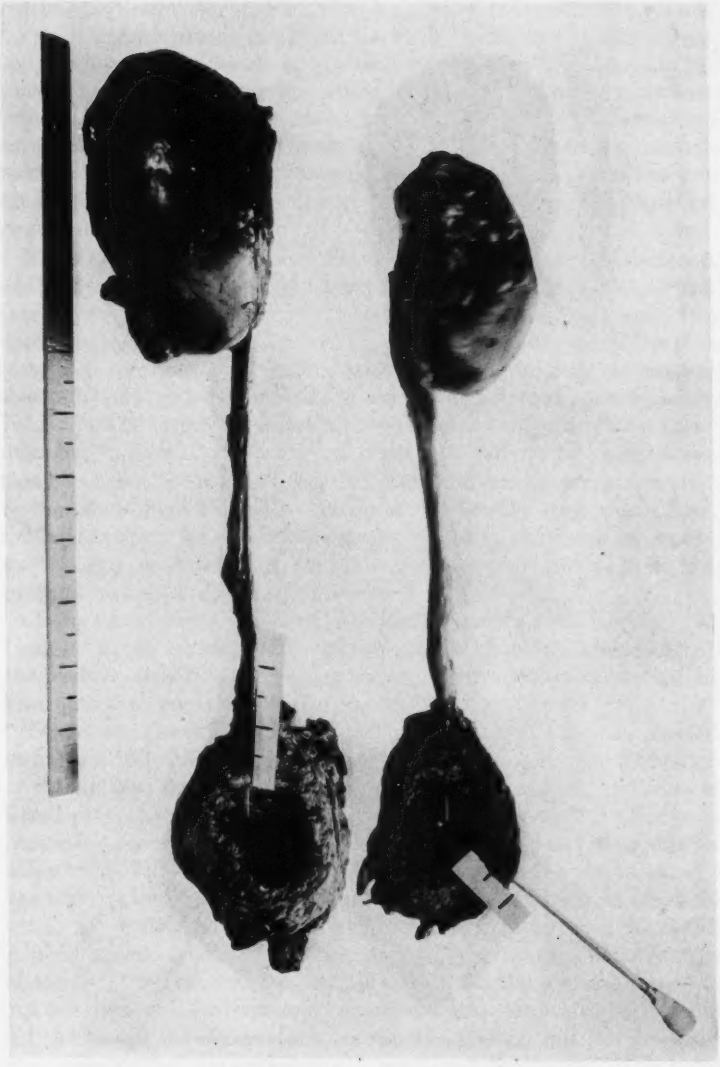

FIG. 1. Note the uniform thickness of the bladder wall. The excursion of the ureter through the bladder wall is 1½ inches. The grooved director is in the urethra.

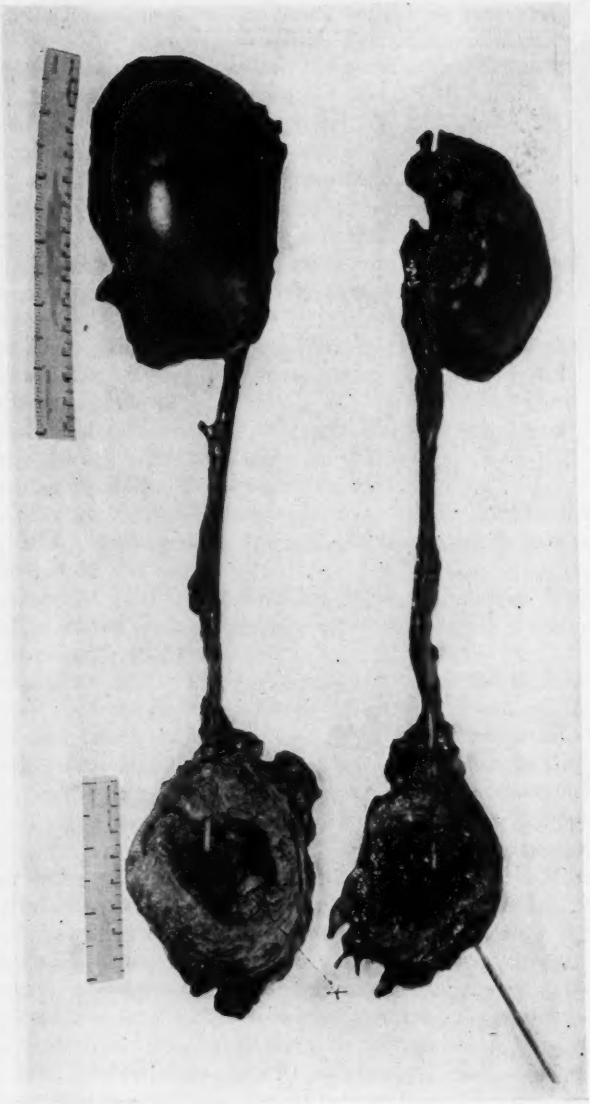

FIG. 2. The tumor seen on cystoscopy is shown at *X*

metrical projection, the mucosa whitish and anemic over it, arising about 4 o'clock and projecting in toward the center. Another similar projection was seen about 5 o'clock, but not of such large dimensions. The mucosa throughout the bladder was more anemic than one usually sees, there was a very greatly diminished capacity of the bladder, about one ounce, the ureteral ora were never seen at anytime, due to the constant leaking of blood, so that we cannot come to a definite and positive conclusion, but are satisfied that the condition is not an ulcer but an actual growth in the bladder wall.

Rectal examination. Showed the prostate symmetrical, it is flattened, small, firm, uniform in its consistency and welded into the bladder wall, there is no perineal fixation, the notch is rounded out, no adenopathy nor the usual feel of an edema in the infiltrating carcinoma of the prostate. We are certainly dealing with something unusual, so unusual that until we hear from the x-ray we would not care to venture a positive opinion. The seminal vesicles are not located, apparently the tumor mass has to do with the bladder and not with the prostate, the impression being that the rounded, globular, slick, uniform tumor has its origin in the actual bladder wall producing a symmetrical overgrowth but is unlike anything we have formerly examined, there being a density, fixation and resistance to it, that is painless on pressure and there is no urethral expression on massage.

X-ray examination. X-ray of the genito-urinary tract by Dr. F. M. Hodges "shows a small and irregularly shaped bladder. The changes in the bladder could be due to either a malignancy or chronic infection, but has more the appearance of malignancy."

Operation, December 22, 1927. The patient's creatin this morning went from 10 to 13, and the blood urea to 123, formerly 90. The output of the kidneys for the night had been only a few drams, and since his blood pressure was 125/80, there was no edema of the extremities, no headache, the fundus of the eyes negative, we could not believe it was altogether of kidney origin but rather retention due to the blocking of the ureteral mouths in the bladder wall. Our opinion was substantiated by Dr. Wyndham B. Blanton, whom we called in to see him. Under general anesthetic, nitrous oxide, administered by Dr. Willis, and assisted by Dr. Creekmur and Dr. Rifkin, we did the extraperitoneal tap upon the ureter. An enormous amount of serum exuded from the wound, all the tissues were edematous, so that the incision was run upward to the lower pole of the kidney in the costo-vertebral angle. The kidney proved to be very large, there was practically no dilatation of the pelvis,

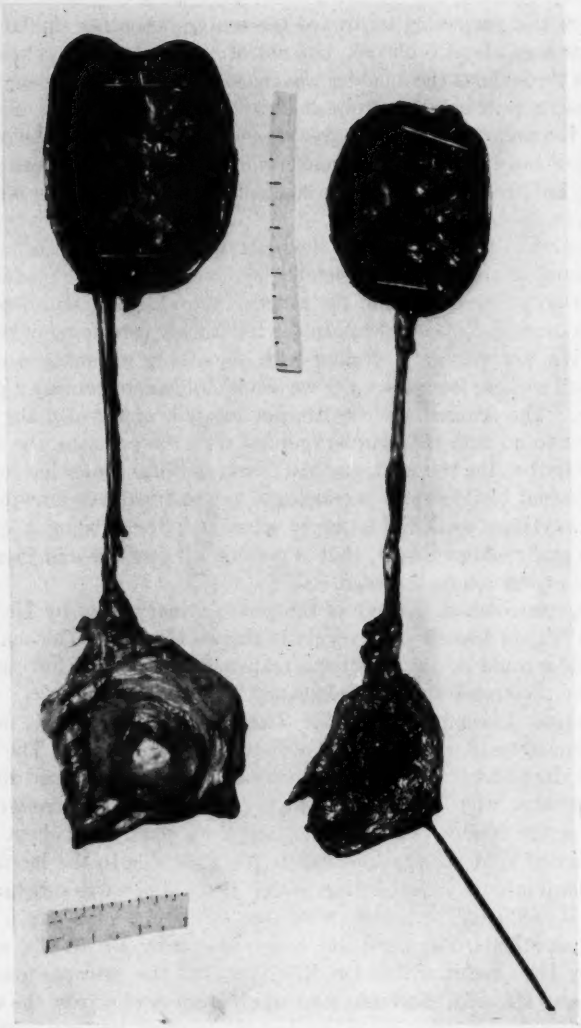

FIG. 3. The kidneys are opened, hemorrhagic extravasation, scattered abscesses and severe pelvic inflammation.

the fatty capsule was readily incised and stripped off the kidney, we believing in a measure it would relieve the kidney tension, and then through the free border of the kidney a trocar was thrust as far as the pelvis and a mushroom catheter inserted into the pelvis for drainage. He stood the ordeal extremely well, was returned to bed in a satisfactory condition. The drainage through the tube was bloody and extremely scant, and apparently only serum. The patient became deeply comatose and died in twelve hours.

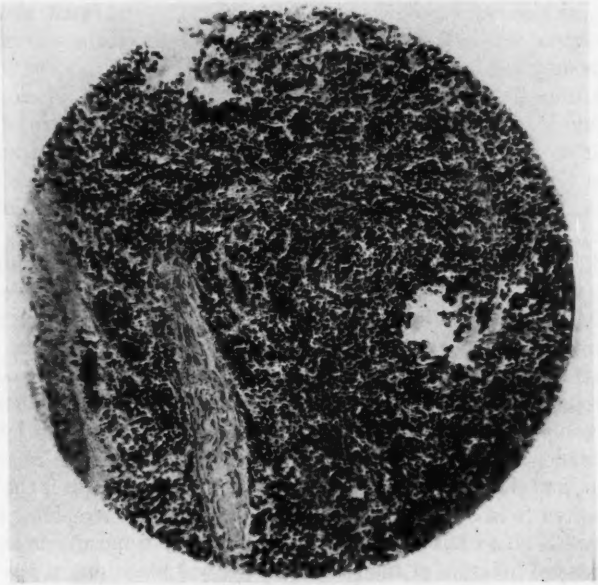

FIG. 4. Section of ovoid, metastatic, encapsulated growth, just outside of bladder wall.

Autopsy, December, 23, 1927. Limited to abdomen. On opening the abdomen the liver appears slightly enlarged, firm, is not further examined. The abdomen is filled with a sero-sanguinous fluid. The colon was greatly distended with gas and lay obliquely across the abdomen.

Stomach. Slightly distended.

Spleen was firm, moderately enlarged and pinkish-violet in color. It was not sectioned.

Kidneys. Right kidney. This kidney was easily removed due to the operative removal of its capsule. The ureter connecting with the bladder was about twice the normal size, considerably congested throughout. The kidney measured 12½ cm. in length, 4$\frac{11}{16}$ cm. thick, 8¾ cm. wide. The surface is dark purplish-red in color, the capsule is already stripped, leaving a smooth, glistening surface. On section the whole kidney is immensely swollen and the cortex bulges beyond the cut margin. There are numerous yellow punctate areas typical of small abscesses. The pelvis of this kidney is considerab.y distended and the mucus membrane is dark red in color.

Left kidney. This kidney is 11½ cm. long, 7½ cm. wide 6¼ cm. thick. This kidney resembles the right except that the distension of the pelvis is considerably greater, the pelvis is larger, redder and contains frank pus. The scattered abscesses in the parenchyma of this kidney are also more extensive. Pressure upon the ureter squirts almost pure pus into the bladder.

Bladder. The bladder was removed with difficulty due to firm adhesions to all the surrounding parts. The tumor mass was larger than the fist and very firm. On section the wall of the bladder, which was on an average ¾ inch in thickness, is firm, grayish-white in color. Both ureters traverse the bladder wall and their lumens could be demonstrated by a probe, though the pressure of the thickened bladder wall must have considerably compromised them. Close to the trigone on the left side of the bladder there is an area of about 1 to 1½ cm. which is raised and irregular, and shows the presence of some hemorrhage. This is the structure referred to in our cystoscopic examination. The remaining mucus membrane is intact but shows here and there some hemorrhagic areas.

No general invasion of the lymph glands was made out, a few small glands were noted in the pelvis close to the bladder.

Prostate. The prostate is small and does not appear to be involved.

Rectum. The rectum shows no changes.

Laboratory report. Dr. S. B. Moon reports on the specimens as follows:

Bladder. Round cell sarcoma, involving the whole wall.

Kidney. Severe acute congestion, with hemorrhagic extravasation, local aggregations of round cells, and cloudy swelling.

DISCUSSION

The histological structure of the bladder is such that with its muscular and connective tissue coats, and highly developed epithelial lining, any of these structures may undergo a malignant degeneration.

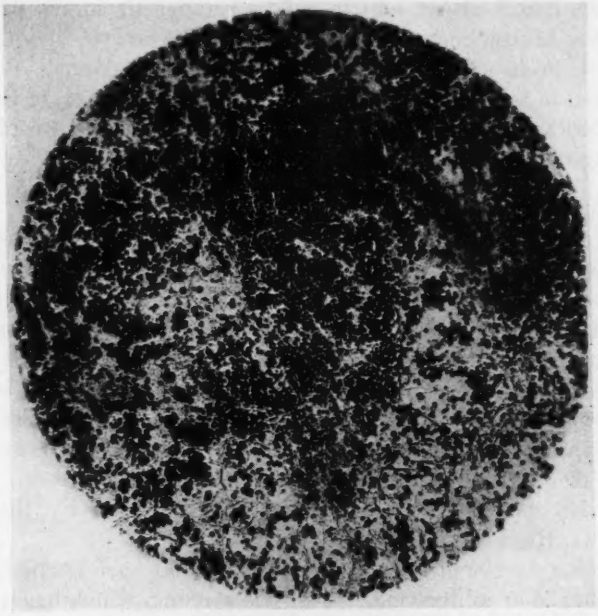

FIG. 5. Tumor cells infiltrate entire wall. No epithelium present

Frequency

Primary sarcoma of the bladder is rare, there being but two instances of this character of growth in eighty-nine tumors of the bladder examined microscopically by Albarran. Sarcoma comprises 56.9 per cent of all infantile bladder tumors, and have been divided by pathologists into sarcomata, myxosarcomata, fibrosarcomata, and lymphosarcomata. Albarran reported 51 cases

of sarcoma altogether, 7 of which were found in the first decade of life. Geraghty found two cases of sarcoma in 180 of bladder tumors. Watson reported fifty-two sarcomata in 863 bladder tumors collected from literature. Gardner reported seven in 369, but the Mayo Clinic gives only one case in 262 treated at their institution. Munwes in 98 collective cases of sarcoma of the bladder, found 15 per cent in children under 10, but of 62 cases from the Massachusetts General Hospital investigated by O'Neill in 1914, in an article "Bladder Tumors in the Young," not one occurred in a patient under ten years of age. Mixter, of Boston, classified the 17 new growths seen in a series in this hospital as embryomata.

Pathology

Sarcoma of the bladder may, however, result as an extension of growth from the surrounding structures. It is well known that the commonest sarcoma in the bladder region are the retrovesical sarcomata, which attack the bladder through continuity of tissue. Carcinoma constitutes an overwhelming per cent of all tumors of the bladder, although endothelioma, teratoma, hypernephroma, myoma, hyatid and dermoid cysts have likewise been noted, and we had the opportunity some fifteen years ago to report a case of angioma of the bladder, which likewise is rare. This particular specimen was diagnosed and described by the late Dr. E. G. Hopkins, of Richmond, Va.

Sarcoma maybe of the round or spindle-cell variety, pedunculated, sessile or infiltrating. A simple sarcoma which has undergone edematous swelling and degeneration, must be differentiated from a myxosarcoma with its characteristic stellate cells. This type of tumor is apt to appear early in life, although cases have been reported as occurring as late as in the fifties.

The extreme malignancy of sarcoma is evidenced by metastases, cellular changes, irregularity in size and shape and staining of the nuclei, abundant nuclei and mitoses. Central necrosis is common, and as Young states, in some cases of spindle-cell sarcoma, the shreds of tumor cells are separated by a quantity of semifluid, gelatinous material, which suggests an embryomatous character.

We feel assured that the enormous uniform thickness of the bladder mass in our case was due to the gelatinous infiltration and edema produced by the rapid cellular infiltration of the malignant growth. Young reports a case of sarcoma of the bladder, removed at operation, showing the typical spindle-cells,

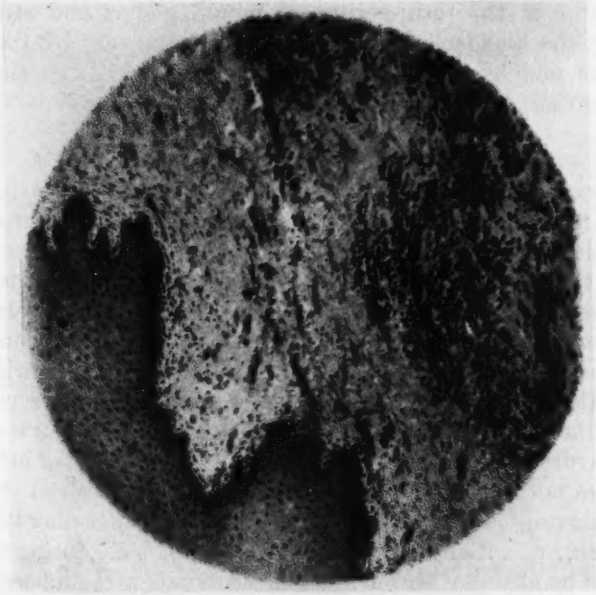

FIG. 6. Epithelium present, practically normal, and not participating

the patient later passed a small fragment of papillary carcinoma. Autopsy in this instance was denied, it was an evident case of of dual implantation.

The location of the growths is apparently more frequently about the trigone, but when on the wall of the bladder they bulge or hang like a cluster of grapes. Those conditions described as mucous-polyps doubtless are of the sarcomatous base. Apparently the two types of sarcoma that confront the surgeons are: (1) the polypoid tumors, which hang bunch-like, of rounded

elevations of mucous membrane with the more or less constricted base, and the other type (2) infiltrating general round cell or spindle-cell sarcoma involving essentially the connective tissue planes of the bladder with generous and symmetrical dissemination. Although occasionally sarcoma may be pedunculated they are usually sessile, with broad bases. Metastases are extremely frequent in the retro-peritoneal lymph glands and structures about the bladder. These metastases occur only by the blood stream and by direct continuity, and are relatively swept off earlier than occurs in the epithelial tumors.

Symptoms

Geraghty calls attention to hematuria as being the earliest and most reliable, occurring in 62 per cent of all vesical sarcomata. The amount of hemorrhage is apparently no indication of the extent of the tumor. Pain is subdivided into two classes by Jamieson, of El Paso, Texas. The first due to the involvement of the pelvic nerves in the malignant process, and second that due to cystitis and ulceration of the bladder. He likewise calls attention to the obstruction and retention due to the pressure upon the ureteral orifices from the growth, producing an intermittent hydronephrosis, or pyonephrosis in the presence of infection. It does not seem to have been sufficiently emphasized that the earlier symptoms of diffuse sarcoma of the bladder may be, as in our case, essentially constitutional and not local, being characterized by an overwhelming blood retention of urea and creatinin, with negative phthalein findings, due directly to the pressure of the growth on the vesical segment of the ureter.

In Jamieson's case autopsy showed the bladder to be extremely thick, well bound down and almost completely filling the pelvis, being very difficult to remove. On section it was grayish-white in color, firm and friable, the kidneys enlarged with dilated pelves. Microscopic examination of this case showed it to be of the spindle-cell variety very closely packed together.

Diagnosis

Diagnosis at best is difficult, since there are two types to contend with, the intravesical cluster of grapes projection, and the general bladder wall infiltration. The cystoscopic picture necessarily must vary, the papillary tumors of the bladder wall with secondary involvement having been mistaken for actual sarcoma.

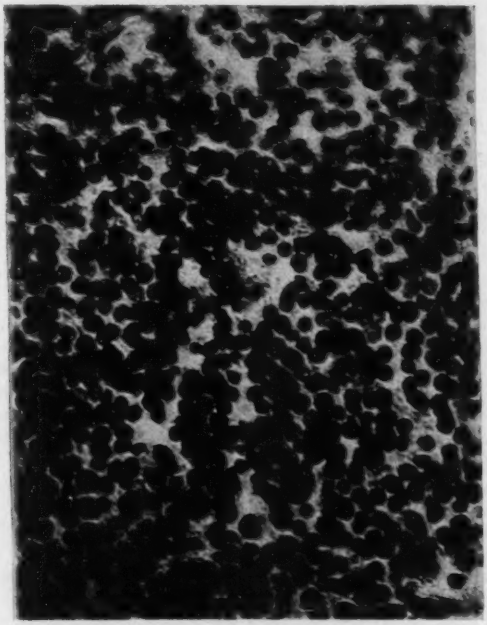

FIG. 7. High power. Round cell sarcoma. Mucosa not involved

Cabot reports a case of sarcoma of the bladder diagnosed by cystoscopy, examination showing an irregular lobulated red tumor in the left half of the bladder, 4 cm. from the left ureteral mouth. This was excised suprapubically, and with it a large portion of the bladder wall, the patient being well nine years after the operation. Another case of sarcoma of the bladder,

reported by Cabot showed an ulcerating tumor mass on the right side of the trigone which was treated with radium, the result not stated.

Verhoogen calls attention to the difficulty of a positive diagnosis of sarcoma and differentiation from carcinoma, because the cancer cells may be closely packed together in the tissues and by pressure assume an elongated or fusiform shape suggesting spindle-cell sarcoma.

Prognosis

Munwes reported that in 69 cases of sarcoma of the bladder 38 died soon after the operation, and only 3 were considered cured. In Albarran's group of 26 patients, 13 died after operation, and 10 had rapid recurrences. This type of tumor apparently has a marked resistance to x-ray treatment and is regarded as a most malignant type of vesical tumor.

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DISCUSSION

Dr. GEORGE G. SMITH (Boston): I feel that Dr. Frontz has hit the nail on the head when he speaks of the diversity of attack which is necessary in tumor of the bladder. The situation of the tumor as well as its type is, of course, a very important factor in the selection of the method of treatment.

My own experience with the two methods of radium implantation and diathermy might be summarized as follows: That for the deep, infiltrating type of tumor, implantation of radium is preferable because one does not dare to burn through the bladder wall or cannot tell the depth to which the diathermy is extending. On the other hand, with the extensive superficial growths, the low bushy type of carcinoma, I have felt that diathermy, better termed electro-coagulation, is preferable to radium treatment because of the long duration of the burns which persist after the implantation of radium even in the protected or screened form.

The chief danger in regard to treatment of carcinoma of the bladder by either one of these methods, as I have seen it, has been the sepsis which is caused, and this sepsis is particularly dangerous if the lesion is situated on or near the trigone. No matter which method is used, a considerable degree of sloughing and infection of the tissues, is bound to result. If the lesion is on the trigone, one gets an edema about the ureters and, as was suggested by the work which was once done by Sweet in regard to the extension of infection along the lymphatics of the ureter, pyelonephritis is probably set up not only by obstruction to ureteral drainage but also by the ascent of the infecting organism along the lymphatics of the ureter. I have felt, therefore, that particularly in a tumor situated in this area, perfectly free bladder drainage for quite a time, three or four weeks at least and sometimes longer, has been a desirable thing. I congratulate Dr. Keyes very much on the results which he got from sewing the bladder up tight but my own experience with that has been that I

almost always felt that I would have had a smoother convalescence and probably a quicker healing if I had left a small suprapubic tube in the bladder than when I have tried to sew these cases up tight.

Dr. Keyes did not say whether he burned off or removed the part of the growth which projected above the bladder wall in a large papillomatous tumor, and I rather assumed he did nothing to that other than the implantation of radium. If that is the case, I should think he would have an extensive mass of sloughing tissue which would sometime or other have to be gotten rid of by the patient. With not even catheter drainage, I should think the patient would have difficulty in passing this sloughing globule through the urethra within the next three or four weeks after operation. I wish he would enlighten us about that.

Dr. KEYES: Take it out; tie off the pedicle.

Dr. SMITH: I would like to say one word about total cystectomy in regard to management of carcinoma of the bladder and to confine my remarks on that subject to the report of one case which I did two years go. This man had both ureters implanted in the rectum extraperitoneally in the small area between the fold of Douglas and the perineal diaphragm. I did the whole job at one sitting, which I would never advise, but I found myself forced to do it. That man came to the Out Patient the other day and was apparently perfectly well. He held his urine from four to six hours; he felt perfectly well; he had no signs of uremia. Rectal examination, however, showed a dense mass in the anterior rectal wall which I suspect is a recurrence. It may be simply scar tissue but I am very much afraid that it is a recurrence. My feeling about total cystectomy is that there are so few cases where total cystectomy is necessary in which metastasis has not already occurred that it is probably an operation which needs to be resorted to very, very rarely.

Dr. J. BENTLEY SQUIER (New York): I would like to say a word on the subject of carcinoma in a diverticulum. I have had three

in my experience and three only. The last one came to me approximately three years ago and the symptom which the patient gave was intermittent attacks of hematuria. I cystoscoped him during his bloodless period and all I could find was a little diverticulum opening on the fundus of his bladder. Feeling that that would not alone explain the hematuria and the fact that a diagnosis of possible carcinoma had already been intimated, I cystoscoped him repeatedly and on one occasion within the next four or five days after seeing him first, I saw blood coming from a diverticulum opening. A cystogram showed the diverticulum. I could not prove in this case that the diverticulum was occupied also by a tumor. An operation was performed and the diverticulum removed. Upon opening the diverticulum an infiltrating carcinoma about the size of a twenty-five-cent piece was found in the wall of this diverticulum. It looked as if here was a case in which you unquestionably would get away with a cure. The man did wonderfully well for a period of eighteen months. At the end of that time he began to develop cachexia, with pains in the perineum and pain in the back of his legs. Cystoscopically his bladder was as negative as a bladder could be. He had no urinary obstruction; although he was a man of sixty years, there was no prostatic enlargement.

We put him in the hospital and searched him from head to foot by every known method we had at our command to discover if he did not have some malignancy elsewhere. The rectal examination, cystoscope and x-ray were negative as far as showing any lesions of the bones anywhere was concerned, but the man progressively went down hill. A few months later he went over to Boston to his home and came under the observation of one of Boston's urologists, Dr. O'Neil, and Dr. O'Neil was with the man until his end. Dr. O'Neil wrote to me recently about the man's death. The death, I think, took place some two years or a little over that from the time I saw him. Dr. O'Neil said there was no evidence of tumor formation in his bladder or around his bladder but he had spinal carcinosis.

I would ask Dr. O'Neil to verify that and tell us what his findings were.

Dr. RICHARD F. O'NEIL (Boston): To verify Dr. Squier's statement of this case, at the autopsy this patient's bladder was perfectly normal but he did have extensive carcinoma of the whole bony pelvis, the sacrum and the lower part of the spine. Before his death he had a certain amount of urinary disturbance; first incontinence, then retention with overflow. He had some rectal incontinence also. He had great difficulty in voiding. He used the accessory muscles in the same way that a paretic does. He never had hematuria and as far as the operative field went, the removal of the growth was apparently complete.

Dr. J. BENTLEY SQUIER (New York): I did not feel it was necessary to have Dr. O'Neil verify my remarks but I wanted him to tell the autopsy findings because I did not see the autopsy.

Of the other two cases, of carcinoma in a diverticulum. The patient was a female on whom, about ten years prior to the operation on the diverticulum, I had performed a hysterectomy for fibroid. She unfortunately died in the postoperative period from pneumonia.

The third case was a man again over sixty who lived about eighteen months with no recurrence as far as I could judge, and then I lost track of him. But I think the lesson is in the case in which I know there was no carcinoma in the bladder when the man died, yet he did die of a bone carcinoma or carcinosis which could not be identified by any form of examination.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): The paper by Dr. Frater was of great interest to me because it has answered several questions which I had long asked as to the value of the diagnosis made from specimens removed on cystoscopic examination. Looking over the literature one finds that there is a great difference of opinion expressed by a number of very good and thorough observers. The result of this study shows conclusively the value of removing these specimens. According to Frater's study, the same degree of malignancy is found in all portions of the tumor in practically every instance. It seems to me that this is of fundamental importance in the diagnosis of bladder tumors.

After all is said and done, Dr. Frontz' and our own observations are not so far off as they may seem. For practical purposes there are actually three grades of malignancy: benign, moderately malignant and very malignant. Grades II and III are sometimes very difficult to separate, often largely depending on the personality of the pathologist. There is usually no doubt, however, in anyone's mind in regard to the difference between grades I and III, or II and IV, or I and IV. I dare say grades III and IV correspond to the infiltrating types Dr. Frontz refers to, and it is quite true that grade I is never infiltrating. However, the Broders classification is a finer differentiation and one of great practical value. The surgeons should be desirous of knowing whether a tumor is grade I or grade IV, and I think Dr. Hunt will bear me out in this. Although there may be other circumstances involving the growth which will predominate in determining the type of operation indicated, nevertheless there is much of value in knowing the grade of malignancy.

I question very much whether one can tell on cystoscopic examination whether a tumor is infiltrating or not. It is true that those tumors which are Grade I and Grade IV can frequently be recognized as such on inspection. If, on rectal and vaginal palpation there is evidence of extension of the growth beyond the bladder wall, then we will, of course, know that the tumor is infiltrating. But with most tumors it is impossible to say on cystoscopic examination or on physical examination, whether they are infiltrating or not. It is in this group that it is of such great value to be able to determine the degree of malignancy by means of specimens removed at cystoscopy. I believe we should use all the available methods of diagnosis at our command and not use the cystoscope or cytology alone.

Dr. David W. MacKenzie (Montreal): I just want to add a case that we had some time ago to Dr. Hunt's interesting series. About six years ago now a man, fifty-two years of age, was admitted to the service with a marked frequency of urination and painful urination. His general condition was not good. His urine was extremely dirty. The x-ray of his bladder showed (slide) what looked to be a stone in a rather abnormal position.

(Slide) This is a cystogram showing the stone up in the diverticulum and the bladder pushed considerably to one side. The diagnosis at that time was made of a stone in the diverticulum with probable bladder tumor down near the neck of the bladder. On operation the diverticulum was found to be quite large and the ureter passed down close to the outer margin. I felt we would have to transplant the ureter but in time it freed itself. Incidentally, we catheterized those ureters. We resected the diverticulum with its tumor and sent it to the laboratory. The man had a slightly stormy convalescence the first week, his temperature being very high; following that, it subsided and he went along very well. For two years he reported to us about once in six months. He moved to another town and then we lost sight of him.

When I saw the program the other day, I wrote him asking how he was and I received a reply from his son who said that his father died two years ago—that would be four years after the operation—from some condition that had shown no bladder symptoms. Following is a copy of the report of the microscopical examination which I took from our files.

"Specimen consists of what appears to be the wall of an elongated cyst, the wall is very thick, varying from ½ to 1 inch, the size of the sac is roughly elliptical 4 by 3 inches. The mucous surface is shiny, slightly congested, here and there there is a slightly gritty material. The other surface is dirty red with here and there grayish blue areas. It is rather soft, cartilaginous, but in some areas it is hard and firm. The cut surface is pearly white with bright yellow streaks through it—at the margin there are some irregular reddish polypoid masses.

"The calculus is large, grayish, about 1½ inches in diameter, inclined to be scaly.

"Microscopically sections through the mass show it to be made up of mature fibrous connective tissue and smooth muscle fibres, infiltrated almost completely by islands, bands and strands of squamous epithelial cells growing diffusely and actively. In areas these squamous cells are thrown up in typical cancroid pearl formation.

"*Anatomical summary:* Squamous celled carcinoma in wall of ovoid diverticulum of bladder with calculus."

Dr. BENJAMIN S. BARRINGER (New York): I am glad to see that at last we have gotten down to Broders classification and I think we owe a great debt to Dr. Broders for this classification. Dr. Ewing insists, as far as I understand, on making the graded diagnosis of tumor malignancy in the observation of considerably more than one cell.

I think the important thing we have gotten from this classification is that the more malignant the tumors are, the more nearly they come into the grade III or possibly the grade IV of Broder's, the more radio-sensitive they are and the more nearly they ought to be cured by radiation of one sort or another and the more dangerous they are for operation. I think that is borne out in a very interesting way in a series we had of carcinomas of the cervix, which are heavily radiated externally and internally, particularly externally; in all the cases of advanced carcinoma of the cervix we found that only those went over five years which were of the grade III class. The most radio-sensitive, the most malignant, were the only ones that were well over five years. We are attempting to look over our prostate and bladder carcinomas to get some data on this.

The practical application of this is: You get a specmen first and if that is in grade III or IV, whichever you will, the most radio-sensitive grade, then those cases should be treated rather differently from the others, the less malignant grades. They should be first radiated externally as heavily as possible.

I had one case lately—a gentleman, a patient eighty years of age—in which we got a specimen from a bleeding tumor which Dr. Ewing diagnosed as extremely malignant and radio-sensitive. This man was eighty years of age, and we decided to treat him, if possible, externally by radiation. I gave him deep x-ray therapy and x-ray pack. He stopped bleeding and then commenced to bleed again. I thought this external radiation was hopeless and so I did a cystotomy and found a handful of tumor loose in the bladder, with no place in the bladder which I could

identify as the base of this tumor. This is the first case I have had in which this sort of tumor has been removed by external radiation.

So I believe that first you must get the specimen and then depend upon the pathological report for the next move. I believe that grade I can be infiltrating just as well as grade III. The squamous cancer may be and generally is, very radio-in-sensitive or may be a soft type, very radio-sensitive. I had one of that type a couple of weeks ago.

After we are through with external radiation, much more intense than we formerly used to give, then we do whatever therapy we think best, presumably in a large tumor suprapubic cystotomy.

As to Dr. Keyes' sewing up of the bladder—if the patient, after the radium implantation, does not bleed and has not much slough in the bladder, I am willing to sew the bladder up tight. I have done that recently in an infiltrating bladder which was just as dry as a bone after we got in there; there was no slough in the bladder and we got along perfectly well. As a rule, if a patient bleeds and has slough, I prefer to drain for a few days and it is my impression that they heal up about as quickly as if you had sewed them up.

I think Dr. Keyes speaks of the radium burns and the slough which occurs after radiation. My impression is that this slough, this troublesome slough, and these radium burns, in the light of using good seeds or platinum seeds, occurs in the infected tumors. If you get infection plus radiation, you get slough. I think if you do not have infection and you put radium seeds in that tumor, as a rule you get very little radium burn and very little slough.

I am very much interested to find that Dr. Keyes' operative mortality is precisely the same as mine. I had three deaths in ninety-seven consecutive cases.

My impression is also that re-operation and re-cystoscopic implantation after suprapubic implantation of radium does not occur to me as often as it did three or four years ago. I think I am less afraid of putting in a lot of radium seeds and I would overradiate a bladder tumor rather than underrate it.

I do not at all agree with Dr. Braasch in his saying that one part of the tumor is indicative of the whole pathology of the tumor. I think in 98 per cent of the cases that is so; but no one could have read Mandelbaum's very beautiful monograph in which he showed a papilloma in one part and a papillary carcinoma of another part of the same tumor and not believe this a proved fact. Most tumors, however, run exactly to type.

There was another point which came up and that was the question of a papilloma's running always true to type. I thoroughly disagree with that. I had a papilloma which was operated upon by various people at various times in which the whole bladder was full of pure papilloma, handsful of it. I was sure of that. Dr. Ewing went over the specimens with great care and pronounced it pure papilloma. That man died within a year, of an extremely, very malignant infiltrating carcinoma of the bladder.

Dr. JOSEPH F. MCCARTHY (New York): My conception of this subject can be summed up in a very few words. I believe once malignancy of the bladder is satisfactorily demonstrated, whatever the treatment we employ, it should follow a complete liberation and mobilization of the bladder.

I fully agree with Dr. Braasch in his feeling that cystoscopic or any other type of examination can give no true conception of the depth, penetration or extent, especially of an infiltrating malignancy, and unless we have that conception to begin with, we are in no way prepared properly to combat it. Any one who has done a considerable number of resections—Dr. Hunt, I think, will verify this—has frequently been surprised at the degree of extravesical extension of these growths. If that be so, I think to implant radium, to diathermize, or to treat these growths in any physical manner, without a precise knowledge of the base or in other words, the extravesical aspect of the growth, is merely playing with the subject. True, in many cases results will be had, but if my experience counts for anything, these results will be temporary.

A precise knowledge of the cellular characteristics of these

growths should also be had at the earliest possible moment. This point Dr. Bumpus has well brought out.

Total cystectomy. Most of us believe that total cystectomy should rarely, if ever, be done. We think of it in terms of ourselves. We must, however, frequently visualize the question in terms of the wage-earning capacity of the patient. I have in mind a case of malignancy in an extrophic bladder where nephrectomy was done on one side, with total cystectomy and ureterostomy. It is now three years after operation. In the intervening period that patient has been supporting his wife as a result of his activities.

In so far as transvesical manipulation or management of these growths is concerned, personally, while I am very much interested in Dr. Keyes' results and with the hope that the future will demonstrate the feasibility and advisability of that procedure, at the present time I believe it better to keep the suprapubic wound open, observe it transvesically through a Pan Endoscope and through this instrument carry out such additional therapeutic measures as occasion requires.

Dr. HERMAN L. KRETSCHMER (Chicago): I am not quite sure that I understood Dr. Bumpus in reading Dr. Frater's paper, and if I understood him incorrectly I hope he will straighten me out. I understood Dr. Bumpus to say that benign papilloma never undergo malignant change. Is that right?

Dr. BUMPUS: Yes.

Dr. KRETCHMER: I, as one at least, wish to take exception to that statement and do not believe that it ought to go unchallenged coming from this Association.

I believe that some of the cases of so-called benign papilloma of the bladder do have the power to undergo malignant change and I am sure that many of you have seen the type of so-called benign papillomata that later on have undergone changes easily recognized as carcinoma and from which the patients have died. I simply wish to make that exception to Dr. Frater's paper which I enjoyed very much.

Regarding the question of malignant tumors in bladder diverticula, I think the statement is justified that this is an extremely rare condition. I think Dr. Hunt reported only eighteen cases in his paper. If you will remember the large number of diverticula that you have seen and the very few instances in which malignant tumors are found, you will at once agree that this is a rare clinical entity.

Not only is carcinoma a rare lesion in diverticula, but leukoplakia, as has been brought out in the papers, is also rare. Papillomata and hemangiomata have been found so that all sorts of lesions are possible in diverticula. Many of the cases reported in the literature are very fragmentary and the case reports most incomplete.

Dr. Squire has called attention to the difficulty in making a pre-operative diagnosis and this may occur if, for example, the tumor is very small, hence, cannot be seen. If the tumor is very large and grows into the bladder, it may be impossible to make a satisfactory cystoscopic examination. This happened in one of my cases and also in a case reported by Hugh Young some years ago. In my case, the whole bladder was full of tumor that had grown out of the diverticulum. One must be very careful not to misinterpret the findings. Dr. Hunt said some of the cases undoubtedly are primarily in the bladder and may grow out around the bladder and make a so-called pseudo diverticulum.

Cystograms should be of great value in making a diagnosis. In cases in which the tumor is small they may show filling defects in the diverticulum. Harris reported one such interesting case and made a pre-operative diagnosis from the filling defect. On the other hand, in cases in which the diverticulum is filled solid with tumor, there, obviously, the cystogram will not help out.

The importance of hematuria as a symptom in this group of cases has been mentioned by Dr. Squier. Our patient had a very profuse bleeding.

As far as I can judge, results have been extremely bad. Many of them, as you know, recur in the bladder.

Dr. Francis R. Hagner (Washington): I was very much interested in the report of Dr. Bryan. In our experience we have

had only two cases of sarcoma of the bladder and, rather a remarkable thing, both occurred within two months of each other. This was a good many years ago. The first one had recurrence very shortly after he left the hospital, and promptly died. The other man had recurrence almost before he left the hospital after he was resected. We left the suprapubic drain in. The wife was a doctor and she would not let any other doctor see this patient.

The tumor in both of these cases had a capsule. In the second case, I was confident it was a sarcoma from the appearance of the previous one and it proved to be. It was a round cell sarcoma and a tumor about that size (indicating). The bladder was resected, the tumor was removed and almost immediately he had recurrence of the growth. That man lived nine years and during that entire nine years he was passing tumor masses through his suprapubic tube. He finally died from some other disease. We may say that the pathologist made a mistake. I think that is hardly possible. He is a very good man and there is no question about the tumor's being there and being removed.

I was very much interested in what Dr. Bumpus had to say in his communication. I think he is to be congratulated on the accuracy on which they make diagnosis from sections removed from these tumors. We have had a number of cases where the diagnosis of malignancy has been made and for some reason it has been considered inexpedient to do a radical operation on account of the patient's age and fulguration and the use of radium has been employed. I do not believe that radium usually cures malignant cases, although some of our distinguished gentlemen here say it does. Where those cases get well under that treatment, I do not believe they are malignant.

Another thing, I do not believe you can make a diagnosis of malignancy by inspection of the growth because usually the growth covers your infiltrated area and you cannot accurately make a diagnosis of malignancy by inspection. As one of the speakers said, we have had patients where the growth in the bladder was very small and did not look malignant and yet on operation, the whole prevesicle space has been filled with a tumor mass.

Dr. JOSEPH HUME (New Orleans): I just want to mention a small point which perhaps accounts for some of the differences of opinion and which I have never heard brought up and that is the relative strength of the fulguration current. I had an assistant who had spent some time in Kansas City where he did urological work. He was then with Dr. Keyes at Bellevue, and then with Dr. Geraghty at the Hopkins. In all of that time he had considerable experience, of course, with bladder tumors. Up to that time he had never heard an explosion in the treatment of bladder tumors through the cystoscope. That is a very curious thing because it illustrates that over the country there must be a great difference in the power of the current and in the probable result and I really think we have no way of measuring that current. When we have these discussions about bladder tumors with high fulguration versus radium, nobody ever talks about that.

The second point is a little point in technique to prevent dissemination, and that is, as soon as you open the bladder to pour in alcohol and ether and acetone and let it stay in there for five minutes and then wipe it out.

The third point is this: You take a teaspoon, or a dessert spoon or a tablespoon and cut a big **V** right down the middle. You slip that under the tumor and you hold up the tumor without touching until you see the base and you take the high frequency current and cut off the pedicle.

The fourth point is about a diverticulum, which could not occur today. In 1904 when I was first in New Orleans, a distinguished surgeon sent me a case and I found a mulberry calculus. That was in the days when we used the Caspar cystoscope. He operated and he did not find the stone. I was very much blamed and urology was completely discredited. There was a little diverticulum in the bladder at the time which I told him of. We did not know much about diverticula in 1904 and the patient never got well. About three months later, however, he came to the surgeon and the surgeon found the stone in the suprapubic wound.

Dr. WILLIAM A. FRONTZ (closing): It seems to me that a very important phase of the question regarding the selection of the

most effective method of treating tumors of the bladder concerns the definition of malignancy. Are we to determine the degree of malignancy in a given case by cytological study of the tumor, or upon the extent of its infiltration of the bladder wall? It is, of course, not uncommon to find superficial tumors which respond to simple endovesical methods of therapy which present a microscopic picture which is indistinguishable from tissue from the surface of deeply infiltrating tumors which can only be handled by resection.

I was very glad to hear Dr. Braasch say that grades III and IV were invariably infiltrating tumors. Dr. Barringer, however, makes the statement that even grade I may be infiltrating and it makes the whole situation rather confusing. I can not help but feel that the cystoscope will, in a large percentage of these cases enable us to differentiate the infiltrating from the noninfiltrating tumor and thereby outline a type of treatment which will be more rational and successful than that prescribed by information gained from microscopic examination.

While statistics differ somewhat as to the percentage of so-called papillomatous tumors, we felt from a study of our series of something over 700 cases that we could classify as papillomatous or noninfiltrating in the neighborhood of 35 per cent. Other men give even higher figures. If I am not mistaken in a report made not long since by Dr. Lower, a percentage of noninfiltrating tumors was given as 52 per cent. I think, therefore, that differentiation between non-infiltrating and infiltrating tumor should be made, if possible, because of the fact that so large a percentage of cases can be handled by nonsurgical methods.

I was very much interested in Dr. Frater's statement regarding specificity of tumors. That is to say, that tumors starting as grade I will constantly remain in this particular grade and not become more malignant. In my experience which conforms more or less with Dr. Kretschmer, I feel quite certain that I have seen tumors undergo malignant change. I can recall numerous instances of superficial tumors which were certainly relatively benign and which responded to such simple methods as fulguration or a combination of radium and fulguration recur at the original site as an infiltrating tumor.

Dr. EDWARD L. KEYES (closing): I think I answered Dr. Smith's question. We remove tumors for the purpose of getting a view of their base, not for the purpose of curing the tumor. We try to do that with radium.

I shall confine my remarks to those of Dr. McCarthy. He has disagreed with me and I must continue, in honor, to disagree with him. I would urge him to note, however, what has happened to the gynecologist who held out so faithfully for operative attack upon carcinoma of the cervix. I hope he lives long enough.

Dr. VERNE C. HUNT (closing): I have not anything to say particularly on my paper, but I would like to corroborate what Dr. Braasch said about grading of tumors as far as a guide to operation is concerned. We have come to look upon preoperative grading of tumors as an important guide to the justifiable extensiveness of the operation contemplated. If we have a grade II epithelioma which proves upon operation to be quite extensive, we are much more apt to go ahead and do an extensive operation upon that patient even including a division of the ureter reimplanting or ligating it and dropping it back; that is, doing an extensive operation and assuming a pretty fair risk for we know with that, in a low grade of epithelioma, the chances of getting good results are much better than with a high grade malignant lesion.

However, if we have a preoperative diagnosis of grade IV epithelioma, we would not consider the extensive operation we would for the same degree of involvement of a low grade; that is, it comes down to the percentage of risk of the operation in relation to the prospects of cure. I think we can say that as a general rule: When the risk of an operation exceeds in relative percentage the percentage prospect of cure, the operation is hardly justifiable.

LEUKOPLAKIA IN A DIVERTICULUM OF THE BLADDER

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There have been numerous contributions during the past few years to the literature of diverticulum of the bladder, also of leukoplakia of the bladder. These additions represent the early resort to precise methods of urologic diagnosis now available, with the institution of proper methods of treatment.

Diverticula of the bladder have long been recognized as a menace to the individual. The impossibility of eliminating an infection when once established in a sac connected with the bladder, which sac will not empty itself, predisposes to the same lesions in the infected diverticulum that would be found in an infected bladder containing residual urine. In the literature on diverticulum of the bladder, cases of tumors and calculi found in a diverticulum have been reported but a complete review of this literature on diverticulum of the bladder has revealed but two reported cases of leukoplakia in a diverticulum without involvement of the bladder itself.

Blum (1) in his monograph on diverticulum of the bladder, cites a case of leukoplakia in a diverticulum and shows an illustration of the same, while Czerny (2) reports such a case which was cited by Kretschmer (3) in his review of the literature on leukoplakia of the bladder in 1920.

Hennessey (4) in a recent review of leukoplakia of the bladder brought the number of reported cases of leukoplakia of the bladder to 79 but does not mention the coexistence of leukoplakia with diverticulum.

The following case, a male, age forty-four, was first seen August 30, 1927. The immediate reason for consulting me was that pus cells had been found in his urine on examination for life insurance.

Questioning revealed the fact that frequency and dysuria had been present for several years and he had noticed a diminution in the urinary stream. He had had no hematuria. Gastro-intestinal symptoms had been present and headaches frequent for several years. Two years previously he had an appendectomy and herniotomy. Several teeth had recently been extracted.

FIG. 1

The family history was irrelevant. Physical examination was negative aside from evidences of malnutrition. The Wassermann was negative. The prostate was not enlarged but moderately congested. The seminal vesicles were atonic and filled with debris. After voiding a catheter was passed and 6 ounces of foul urine obtained. A cystoscopic examination showed a con-

gestion of the entire bladder wall, trabeculation throughout, and numerous shallow cellules in the base Two cm. posterior to and to the outer side of the right ureteral orifice there was an opening 1.5 cm. in diameter leading into a diverticulum which had a capacity of 8 ounces. On X-ray catheter was coiled up in this diverticulum and a roentgenogram made.

The patient entered the hospital October 31, 1927. An in dwelling catheter was inserted. The urine cleared, and on

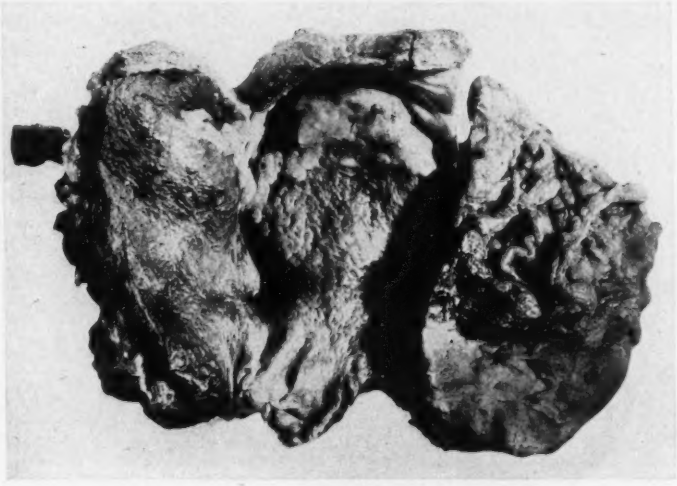

FIG. 2

November 21, 1927, the diverticulum lying to the right of and posterior to the bladder was resected. The vesical orifice was thoroughly dilated. The bladder mucous membrane was normal aside from a moderate congestion. Suprapubic drainage was removed eight days later and the sinus closed promptly, the convalescence being uneventful.

Examination April 10, 1928, shows that the patient empties his bladder. Cystoscopic examination shows a normal bladder.

The pathological examination of the specimen by Dr. Knox is as follows:

Macroscopical examination. Specimen consists of a diverticulum from the bladder; collapsed, it measures 5.5 by 4.5 by 2 cm. The serosa is covered with fat. The opening into the diverticulum is 1.5 cm. in diameter. The wall is edematous being 0.8 cm. in its thickest portion.

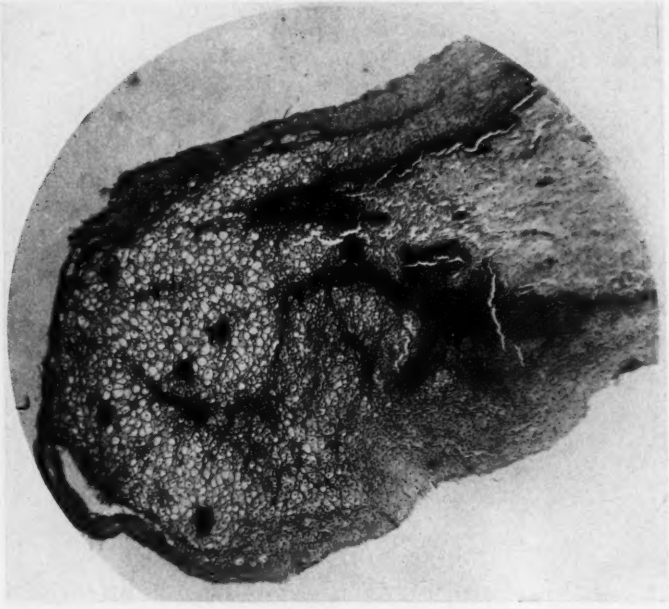

FIG. 3

The lining is smooth and in places is hypertrophied, so as to form an irregular, thickened, leukoplakia-like membrane.

Microscopical examination. Sections of the wall of the diverticulum show a lining of the bladder epithelium which is very markedly thickened and shows leukoplakia-like areas in the denser portions. This is largely formed by outgrowths of the upper layers. The deeper ones are less affected and show no tendency toward invasion of the basement membrane.

The remainder of the wall of the diverticulum is fibrous only and does not contain muscle fibres. There is a marked round cell infiltration within this fibrous supporting tissue.

Diagnosis. Leukoplakia in a diverticulum of the bladder.

Leukoplakia is almost always associated with long continued chronic infection, is slowly progressive, and the only cure is by excision. Its principal importance is that it is apparently a necessary preliminary to epidermoid or squamous carcinoma, and the possibility of its occurrence in a diverticulum of the bladder is another strong argument for the early removal of a diverticulum by resection.

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LEUCOPLAKIA OF BLADDER AND DIVERTICULUM RESEMBLING CARCINOMA

A. R. STEVENS

Several publications of recent years have brought together the cases of leucoplakia of the urinary tract recorded in the literature. The condition may seem rare from the fact that the total number is well below a hundred, but in all probability the members of this organization alone could easily account for an equal number of cases of leucoplakia should they search their personal and hospital records. The writer has seen at least four or five, two of which came to operation with subsequent histological confirmation of the diagnosis—one with the lesion in the kidney pelvis, and one in the bladder. The latter case is here reported to draw attention to four features—the passage of chunks of epithelium in the urine, the absence of other symptoms, the presence of leucoplakia in a bladder diverticulum, and the cystoscopic resemblance of the bladder lesion to carcinoma (without the presence of any microscopic malignant changes).

The passage of large and small pieces of membrane has been noted quite frequently in the reported cases; Lendorf's patient had seen such masses in the urine for ten years. However the diagnosis of leucoplakia was made by the surgeon from examination of these pieces in only two reported instances, those of Beer and Stockman. In the reports by Brik and by Escat, each author records one case with protruding masses which may have had some resemblance to the appearance well shown in one of the illustrations (fig. 1) accompanying this brief article. A perusal of the published cases in the literature as collected by Kretschmer, by Hinman, Kutzman and Gibson, and by Briggs and Maxwell, reveals but one instance of leucoplakia occurring in a diverticulum; that was reported by Czerney, and the condition was found only after the diverticulum had been extirpated at operation.

CASE REPORT

The patient, a man fifty-eight years old, was first seen January 17, 1927. There was but little relevant past history. He had had gonorrhoea about 1912, and a bladder stone had been removed by suprapubic operation in 1917. Recently there had been no hematuria nor dysuria and but slight frequency, urinations being every three to four hours by day, and sometimes once at night. During the past six years he had noticed pieces of gray tissue in the urine every few months. This was the only com-

FIG. 1. CYSTOSCOPIC VIEW SHOWING BLADDER DIVERTICULUM ALONG THE EDGE OF WHICH IS AN AREA OF LEUCOPLAKIA WITH HEAPED UP EPITHELIUM, RESEMBLING NEOPLASM

plaint and led him to seek the advice of his physician Dr. D. W. Atchley, who sent a urine specimen to a pathologist. The latter cut sections of some of the bits of tissue obtained and reported that although advanced autolytic changes had occurred:

> The material takes a diffuse eosin stain which shows the tissue to have the outline and arrangement of squamous epithelial cells, although no nuclear structures can be distinguished. These cells have a pavement arrangement and while it is impossible, because of the autolysis, to state whether the process is malignant, yet the arrangement of the cells does not suggest a malignant tumor.

On examination the patient appeared in good health, the chest and abdomen revealed nothing abnormal, and the external genitalia were normal. The urine was cloudy with large heavy particles; there was a faint trace of albumin, no sugar, little pus and many bacilli; the solid particles were composed chiefly of epithelium. The prostate was slightly enlarged, rounded and boggy; its secretions contained about 50 per cent pus; the seminal vesicles and base of bladder felt normal. The phenolsulphone-

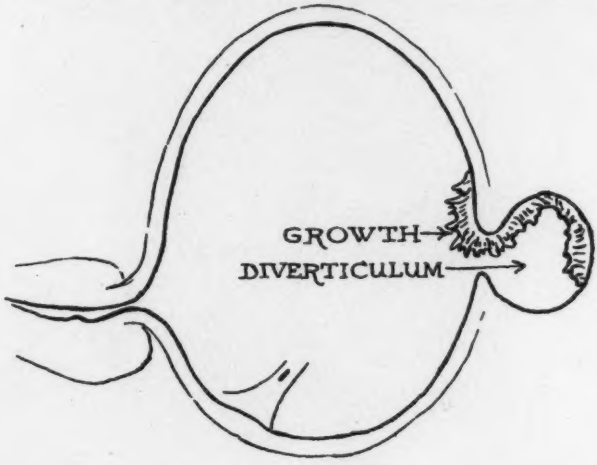

FIG. 2. DIAGRAMMATIC SKETCH INDICATING SITE OF INVOLVEMENT OF BLADDER WALL AND DIVERTICULUM BY LEUCOPLAKIA

phthaline excretion was 62.5 per cent in two hours. Residual urine 25 cc.

Cystoscopy was simple; the ureteral orifices and the bladder mucosa were practically normal. On the posterior wall of the bladder, to the left of the midline and well above the trigone, was the opening of the diverticulum with a small, gray, irregular mass overhanging its right side. The cystoscope was easily made to enter the diverticulum and showed that about two-thirds of its wall was covered with a pearly gray, shaggy material, which had a well defined border, and was similar in appearance to the mass

seen in the bladder. Carcinoma seemed the probable diagnosis, and cystoscopy was repeated to permit an artist to make the accompanying illustration (fig. 1). A cystogram made with 5 per cent sodium iodide in the bladder, confirmed the presence and size of the diverticulum (fig. 3).

FIG. 3. CYSTOGRAM OF BLADDER AND DIVERTICULUM

Operation was performed January 27, 1927, under spinal anesthesia; after forty-five minutes, inhalation of ethylene was added. Exposure was made through a midline suprapubic incision. The peritoneum was opened and the iliac region searched for enlarged glands, but none were found. The peri-

toneum was stripped off the bladder wall and was sewed up before the bladder was opened. The bladder was well mobilized, opened in the midline at the vertex and incised down the posterior wall to the diverticulum, and around this, including the small mass which was roughly about 1 cm. in diameter. The superficial part of this

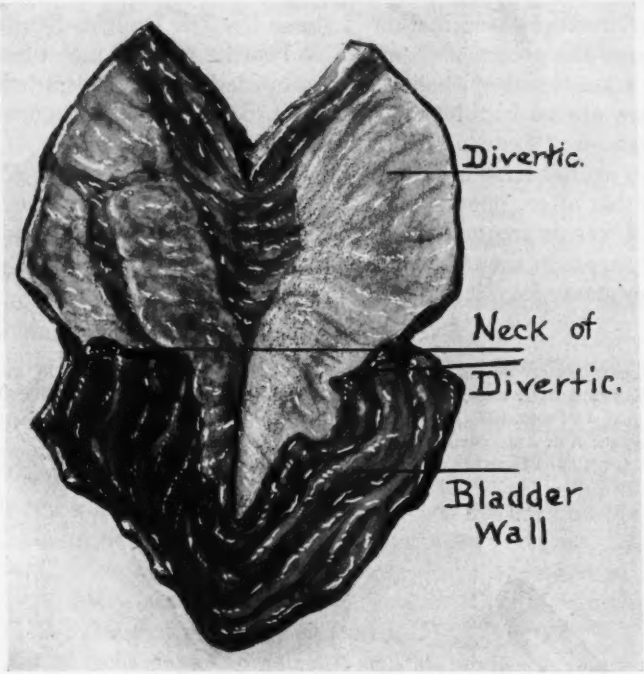

FIG. 4. TISSUE REMOVED AT OPERATION, SHOWING BLADDER WALL AND THE DIVERTICULUM WHICH HAS BEEN CUT OPEN. AREA OF INVOLVEMENT BY LEUCOPLAKIA IS EVIDENT

mass was easily brushed off by light sponging. The diverticulum ran downward under the trigone but was easily freed from bladder and rectum by blunt dissection. The tissue removed is well shown in the illustration (fig. 4). The bladder was sewed with plain catgut followed by a continuous suture of fine chromic, a

tube being left in the anterior end of the incision. Cigarette drains were placed in the space of Retzius. The muscle, aponeurosis, and skin were closed in the usual manner.

Convalescence was uneventful but for drenching night sweats, and the patient left the hospital in four weeks with normal temperature and the wound closed.

Microscopic examination of tissue (by Dr. Douglas Symmers) "shows the presence of sudden and rather marked metaplasia of the transitional epithelium into stratified squamous epithelium. There are no histological signs of tuberculosis or malignancy." Diagnosis: "Leucoplakia of urinary bladder."

An examination of the patient was made April 9, 1928, fifteen months after operation. He was entirely comfortable and there was no frequency of urination. He had seen no blood nor any shreds in the urine, which was very slightly turbid. Cystoscopy showed no signs of tumor, stone, or diverticulum.

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LEUKOPLAKIA OF THE URINARY ORGANS

A REPORT OF THIRTEEN NEW CASES

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Until quite recently leukoplakia of the urinary organs had received but scant attention in the American literature. Recently a number of very interesting cases have been reported, the authors having very carefully brought the literature up to date. I refer especially to the recent publications by Briggs and Maxwell, Cumming, Hennessey, Hinman, Kutzman, and Gibson; Valentine, Wilhelmi, and Young.

Practically all these articles deal with cases occurring either in the urinary bladder, ureter or kidney pelvis. Cases occurring in the urethra are not so common, at least this is the impression gathered from a casual perusal of the literature.

In two previous publications I reported 3 cases in two of which the kidney pelvis was the seat of the disease and one in which the urinary bladder and the ureter were involved. Since the publication of these papers, articles have appeared in the European literature by Allemann, Broglio, Cirillo, Corsdress, Jura, Li Virghi, Pedroso and Von Borza.

In the present paper no attempt will be made to review the literature because this was done in my own papers as well as in some of the papers above mentioned. Hennessey in his paper, published in January, 1927, found a total of 79 cases reported in the literature. This with the 13 cases of this most interesting condition reported in this paper brings the total number of cases to date up to 92.

In 7 cases it occurred in the bladder; in 3 in the urethra; in 2 in the kidney pelvis and in 1 a kidney pelvis and ureter were affected.

The various theories regarding the pathogenesis have been gone over so many times in recent publications that they will not be considered in this paper. Those who are interested in the theories, as well as in the rôle played by the presence of tuberculosis, chronic infection and stone, may refer to them.

SEX

In a previous publication on the subject of leukoplakia in which an extensive review of the literature was made, the review showed that 34 cases occurred in males, 8 cases in females, and that the sex was not stated in 2 cases. In the present series there are 9 males and 4 females.

TABLE 1

Table of ages

AGE	NUMBER OF CASES	AGE	NUMBER OF CASES
years		*years*	
20	1	48	1
28	1	55	1
33	1	61	1
34	2	62	1
41	1		
44	2	Total.....	13
47	1		

Hennessey in his recent review of 75 cases found that this lesion occurred in the male 56 times and in the female sex 19 times, a ratio of practically 3 to 1. Hinman, Kutzman and Gibson, in their paper, stated that, at least, the lesion in the kidney pelvis occurred equally in the two sexes.

AGE

Age probably has no etiological significance. The age of these patients is as shown in table 1.

SYMPTOMS

The symptoms of this condition are not typical. In many instances the co-existing pathology presents symptoms and signs

which predominate the clinical picture, the leukoplakia being found at the time of the cystoscopic examination in cases where the condition is limited to the bladder, or the condition is observed when the kidney, having been removed, is opened for study. Nevertheless, many authors mention the passage of large flakes of epithelium as pathognomonic of the presence of leukoplakia. Perhaps, it might not be amiss to present the most

TABLE 2

Table of symptoms

	NUMBER OF CASES
Frequency of urination	10
Nocturia	7
Burning	7
Hematuria	5
Pain	5
Pain on urination	4
Pyuria	4
Turbid urine	2
Difficulty	2
Incontinence	2
Loss of weight	2
Backache	1
Retention	1
Chills and fever	1
Urgency	1
Nausea	1
Vomiting	1
Weakness	1
Tingling in perineum	1
Failure of completion of ejaculation	1
Dribbling	1

frequently found symptoms in this series of cases in the form of table 2.

BACTERIOLOGY

Whether or not infection plays a rôle in the production of leukoplakia is open to question. Here, as in the rôle played by symptoms, the question of infection is often secondary to or subservient to the underlying primary condition. The histories

of these patients showed that in 2 cases the urine was sterile and free of infection whereas in 8 cases infection of one sort or another was present. In 3 cases the cultures were not stated. In the 2 cases of tuberculosis of the kidney and bladder both cases showed the presence of tubercle bacilli on smear and guinea pig inoculations.

One of the interesting phases of the subject is the fact that the bacteriological studies of the urine in these cases failed to show

TABLE 3

ORGANISMS	NUMBER OF CASES
B. coli	4
B. coli and Hemolytic streptococci	1
B. coli and Staphylococci	2
B. coli and Streptococci	1
Sterile	2
Not stated	3
	13

TABLE 4

Table of urinalysis

	NUMBER OF CASES
Albumin	11
Pus	11
Bacteria	7
Blood	7
Epithelial cells	5

the presence of any one organism in all the cases, although B. coli either alone or in combination was the most frequent invader. This lack of constancy is also evident in the literature, and furthermore in some cases the urines were sterile, notably in the cases of Cumming and Corsdress. Hinman, Kutzman and Gibson found B. proteus. Wilhelmi found staphylococci, Hennessey, B. coli and staphylococci, and Valentine, streptococci and Gram-negative bacilli.

In this series tables 3 and 4 show the bacteriological results.

PREVIOUS VENEREAL HISTORY

For a time it was suggested that perhaps syphilis played a rôle in the production of this condition. Among the champions of this viewpoint may be mentioned Psodas who believed that leukoplakia, in most instances, offers a pathology the origin of which can be traced back to syphilis, because specific treatment has proved effective. In this series a Wassermann test was made in 9 cases and was positive in 1 case. Nevertheless the present opinion, I believe, is rather against the possibility of syphilis as an etiological factor. Gonorrhea, too, has been held responsible, but in my opinion it can be excluded. The majority of patients in this series denied ever having had gonorrhea and on examination no evidence of that disease was found.

ASSOCIATED LESIONS

Various authors have from time to time included in their reports the detailed study of co-existing lesions. There was a time when some of the men thought that leukoplakia occurred only when associated with stone and hence was due to the presence of stone, either directly or indirectly. This viewpoint we now know to be erroneous because leukoplakia may occur in many instances as an independent disease.

A review of this series of cases showed the following:

ASSOCIATED PATHOLOGY

Urethra

1. Traumatic stricture
2. Urethral calculi with rupture of the urethra
3. No associated pathology

Bladder

1. Stone with chronic cystitis
2. Carcinoma with chronic cystitis
3. Ulcerative cystitis with pyelonephritis
4. Tuberculosis of the bladder secondary to renal tuberculosis
5. Chronic cystitis with median bar obstruction (bifid kidney pelvis, left)

6. No associated pathology (double kidney and double ureter)
7. No associated pathology

Kidney

1. Renal calculi
2. Renal tuberculosis
3. Hydronephrosis (infected)

Case 1

Mr. D. G., male, aged forty-four.

Previous history. Negative. The patient had the usual diseases of childhood and denied venereal disease.

Family history. Negative.

Present complaint. On April 21, 1921, while at work on a crane at a cinder pit, the patient fell on a steel rail in the pit, striking his perineum. There was bleeding from the external urethral orifice in less than twelve hours and complete retention of urine. The next morning he was taken to a hospital, a catheter was passed into the bladder and the bladder was drained per catheter for two days. A few days later an abscess in the scrotum developed, which was opened and drained. A second abscess, which opened spontaneously, developed in the scrotum after the first one healed. Until the abscesses were healed the urine was passed through the incision. Patient remained in the hospital five weeks.

After he left the hospital he noticed that he did not empty his bladder and he was obliged to exert pressure on the perineum with his hands after the act of urination was apparently completed. The same thing was true of ejaculation. The semen did not come out at the time of ejaculation but had to be forced out by pressure on the perineum. The texual act otherwise was normal. Since the accident he has had some singling in his perineum, present only during urination. Urgency was also present occasionally. There were no other urinary symptoms present.

General physical examination. Negative.

Local examination. A small scar was seen at the penoscrotal junction, the site of the incision for draining the above-mentioned abscess. Some thickness and hardness at the penoscrotal junction was felt. A varicocele was seen on the right side.

Rectal examination. Negative.

Blood pressure. Systolic 122, diastolic 80.

Roentgen-ray examination. A healed fracture of the pelvis.

FIG. 3

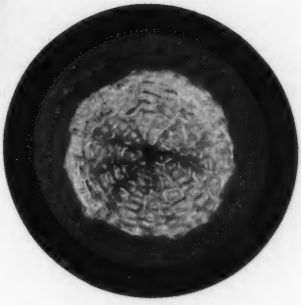

FIG. 1

FIG. 2

Fig. 1. D. G., Case 1. Showing area of leucoplakia in the urethra. The drawing was made through the air endoscope.

Fig. 2. H. S., Case 12. Note the large plaque of leucoplakia. Two small stones are visible.

Fig. 3. F. B., Case 13. Note the extensive leucoplakia formation involving the entire kidney pelvis and ureter.

Leucoplakia of the Urinary Organs.—Herman L. Kretschmer.

Urinalysis. Color, clear; Reaction, acid; Albumin, 0; Blood, 0; Sugar, 0; Sediment, casts 0, red blood cells 0, rare pus cell.

Cystoscopic examination. Negative.

Urethroscopic examination (fig. 1). In the bulbous urethra a white dry lusterless area was seen about the size of a bean. The surface was wrinkled, almost scaly. The edges were sharply defined and stood out in marked contrast to normal mucosa. The posterior urethra was negative.

Exploration of the urethra with a No. 27 diagnostic showed a very firm band at the penoscrotal juncture.

Diagnosis. Traumatic stricture of the urethra; leukoplakia of the urethra.

Case 2

Mr. J. W. K., male, aged fifty-five.

Previous illness. Mumps and scarlet fever in childhood, rheumatism at forty-three, influenza at fifty, urethritis complicated with bilateral epididymitis many years ago.

Family history. Negative.

Present complaint. Patient stated that for the past two years he had noticed a lump under the urethra which had been gradually growing larger and had always been hard and very firm in consistency. Four days before coming under observation, the swelling evidently ruptured into his urethra as blood was passed. Nevertheless, the size of the swelling remained about the same.

During the past year there has been a good deal of difficulty in urination. This increased concomitantly with the increase in the size of the lump, but there was never complete retention. No catheter was ever used. Urination every two or three hours during the day and three or four times at night. A week prior to admission to the hospital, patient developed chills and fever which had been present daily since then. He was obliged, because of apparent obstruction of his urine, to strain a good deal, the force of his stream being practically nil and the urine just dribbled away.

Sexual symptoms were absent.

Physical examination. Patient had a cataract of the left eye. Teeth in poor condition and pharynx infected. Several glands of the neck were enlarged. Lungs were negative. Heart showed a mitral murmur transmitted into the axilla. Examination of the abdomen was negative. Small inguinal glands on the left side. On the right side was a scar,

the result of an operation for hernia. The external urethral orifice was negative. A hard mass was felt at the root of the penis which extended back along the urethra almost to the front of the rectum. The perineum was swollen and sensitive and had the appearance of being edematous. In an attempt to pass a urethral sound an obstruction was met which gave a gritty feeling as though the tumor mass were due to stone. Rectal examination was negative.

Roentgen-ray examination. Stones in the urethra.

Examination of blood. Red blood cells, 4,736,000; Leucocytes, 18,000; Hemoglobin, 95 per cent.

Wassermann test. Negative.

Gonococcus fixation test. Positive ++++.

Urinalysis. Color, turbid; Odor, foul; Albumin, +++; Sugar, 0; Sediment, pus and red blood cells.

Diagnosis. Multiple urethral calculi with urinary extravasation.

Operation under gas anesthesia, April 15, 1921. An incision was made in the median line over the tumor and carried back on the perineum. A large amount of pus and urine escaped. The bulbous-urethra was opened for 2 inches and a large stone and several smaller ones were removed. When the urethra was opened several areas were seen that were white and dry and had the typical appearance of leukoplakia. These patches were in direct contact with the stones. Excision of patches for histological study. This verified the diagnosis of leukoplakia. The wound was closed in the usual manner and drains inserted. The immediate post-operative convalescence was rather trying, due to infection following the urinary extravasation. The wound was irrigated daily.

Culture of pus from the wound showed colon bacilli and staphylococci.

On June 18, 1921, the wound was closed and the patient given permission to leave the hospital. During the night he suddenly developed dyspnoea, profuse perspiration, bloody sputum, sense of weight over the sternum and a very productive cough. The patient died June 19, 1921, of pulmonary embolism. Permission for an autopsy could not be obtained.

Diagnosis. Urethral calculi; Rupture of the urethra; Leukoplakia of the urethra; Pulmonary embolism.

Case 3

Miss B. M., aged twenty-eight, single, referred by Dr. W. E. Post. Admitted to the Presbyterian Hospital, May 21, 1923.

Previous illness. Usual diseases of childhood. Appendix was removed nine years prior to admission to the hospital.

Present complaint. Patient complained of pain in the right lower quadrant of the abdomen which had been present for nine years.

Pain in bladder region, for two months, was severe, sharp, and marked on urination.

Physical examination. Patient was a sallow, undernourished woman of a very nervous type. Pupils reacted to light and accommodation. Sclera, pale. Ears, nose and throat, negative. Heart and lungs, negative. Examination of the abdomen showed some tenderness in the right lower quadrant over the colon. Knee jerks, extremely brisk. Pelvic examination showed the uterus in retroversion, second degree, not easily lifted.

Local examination. When the lips of the urethra were everted two white patches of *Leukoplakia* could be seen which appeared dry and dull. One of these patches was located on the floor of the urethra and one on the lateral wall.

Cystoscopic examination May 23, 1923. Negative. Ureters were catheterized without difficulty or obstruction.

Examination of urine. At the time of the cystoscopic examination it showed the following cultures: Bladder, B. coli, Right kidney, Staphylococci; left kidney, sterile.

Roentgen-ray examination. Negative for stone.

Pyelograms. Negative.

Blood examination. Red blood cells, 5,100,000; Leucocytes, 6,200; Hemoglobin, 66 per cent.

Blood pressure. Systolic 90, diastolic 50.

Wassermann test. Negative.

Many specimens of bladder urines were examined and were negative for tubercle bacilli.

Examination of catheterized specimens, June 2, 1923. Bladder: Leucocytes per cubic millimeter, 21; Cultures, B. coli; Tubercle bacilli, negative. Right kidney: Leucocytes per cubic millimeter, 3; Cultures, B. coli; Tubercle bacilli, negative. Left kidney: Leucocytes per cubic millimeter, 2; Cultures, sterile; Tubercle bacilli, negative.

Guinea-pig Inoculations.

May 24, 1923. Bladder, negative for tubercle bacilli.

July 26, 1923. Bladder, negative for tubercle bacilli. Right kidney, negative for tubercle bacilli. Left kidney, negative, for tubercle bacilli.

June 8, 1924. Bladder, negative for tubercle bacilli. Right kidney, negative for tubercle bacilli. Left kidney, negative for tubercle bacilli.

Diagnosis. Retroversion of uterus. Malnutrition; Hydrosalpinx; Leukoplakia of the urethra.

Case 4

J. C., male, aged forty-seven, seen through the courtesy of Dr. Perry Bromberg of Nashville, Tennessee. Patient was admitted to the St. Thomas Hospital at Nashville, December 10, 1922.

Family history. Negative.

Previous history. Negative except for an attack of epididymitis eight years prior to his admission to the St. Thomas Hospital at Nashville, December 10, 1922.

Present complaint. Patient has had difficulty of urination for the past ten years. He described this by saying that his stream was very easy to start and flowed freely when first started but in about the middle of the act it gradually slowed down to a dribble and finally stopped. He was then forced to wait a few seconds and after relaxing himself, he was able to finish. Straining seemed to aggravate the condition and at times there was a passage of blood-tinged urine. When the stream began to slow down he suffered from a burning pain over the symphysis which radiated towards the rectum. Frequency of urination had been present for many years and at the time the patient presented himself for examination he was obliged to rise every hour during the night and urinated ten or twelve times during the day.

Physical examination. Head and neck were negative except for the very poor condition of his teeth. Heart and lungs were negative. Examination of the abdomen showed some tenderness over the symphysis pubis extending upward to about midway to the umbilicus and extending outward to the outer border or the recti muscles.

External genitalia, negative except for the right testicle which was atrophic.

Reflexes. Normal.

Examination of urine. Specific gravity, 1006; Reaction, alkaline; Albumin, trace; Sugar, 0; Casts, 0; Red blood cells, occasional.

Phthalein tests. A total output of 10 per cent for two hours.

Blood count. Leucocytes 13,000.

Blood chemistry. Urea, 39; Urea nitrogen 18.2; Non-protein nitrogen, 25.

Roentgen-ray examination. A very large stone in the bladder.

Operation. H. L. Kretschmer, St. Thomas Hospital, Nashville, Tennessee, December 12, 1922 (courtesy of Dr. Bromberg). A supra-

pubic cystotomy was done and a very large stone which measured 7.5 by 6 by 4.5 cm. and weighed 6 ounces was removed. At the time the bladder was opened, multiple areas of *leukoplakia were* found. These were removed surgically and sectins were examined by Dr. B. T. Terry of Nashville who verified the diagnosis of leukoplakia.

Diagnosis. Stone in the bladder; Leukoplakia of the bladder.

Case 5

R. K., male, aged sixty-two, referred by Dr. R. B. Oleson. Patient admitted to the Presbyterian Hospital, March 24, 1927.

Family history. Father died at seventy-two of carcinoma of the stomach and mother died at forty-nine of carcinoma of the lungs.

Previous illness. Gonorrhea at the age of twenty, which cleared up without complications. Syphilis denied.

Present complaint. Patient stated that he had always had more or less bladder trouble. He had frequency of urination with burning and nocturia for twenty years. These symptoms had recently become aggravated so that one and one-half years before coming under observation he noticed that his urine had become turbid and comtained a large amount of sediment and he also noticed at that time some discharge at the end of urination. Frequency of urination had gradually increased so that he was obliged to urinate about every forty minutes during the day and about ten or fifteen times during the night. Hematuria began about one and one-half years before coming under observation. It was most marked at the end of urination. He had some deep X-ray treatments which he believed increased his pain, frequency and hematuria.

Physical examination. Head and neck, negative. Heart and lungs, negative. The liver could be felt two fingerbreadths under the costal arch. External genitalia were negative. Rectal examination showed a normal prostate; the base of his bladder felt as though it were greatly thickened.

Blood chemistry. Urea, 11.3; Uric acid, 5.0; Creatinin 1.55.

Blood Wassermann test. Negative.

Urinalysis. Reaction, alkaline; Albumin, ++++; Sugar, 0; Blood, ++; Pus, ++++; Sediment, red blood cells and motile bacilli.

Catheterized specimen of urine. Bladder: Leucocytes per cubic millimeter, 240; Cultures, *Staphlococci albus and B. coli.*

Roentgen-ray examination. Negative for stones in the genito-urinary tract.

Cystoscopic examination (sacral anesthesia, March 25, 1927). A large white necrotic tumor mass about the size of an apple, which extended around the neck as well as around the base of the bladder. There was a good deal of redness of the vesical mucous membrane and some edema.

Diagnosis. Carcinoma of bladder and operation advised.

Operation, April 12, 1927. Suprapubic cystotomy and surgical diathermy of tumor mass. The bladder was opened up and a very large flat necrotic tumor was seen which extended from the upper part of the bladder down to the urethral orifice to the left side as far over as the base of the bladder. *On the right side of the bladder base and wall was seen a very large area of leukoplakia.* A small section of the tumor mass was removed for histological study and the tumor treated extensively with surgical diathermy. A section was removed from the area of leukoplakia for histological study and this was given a very thorough diathermy treatment.

The patient made an uneventful convalescence.

Diagnosis. Bladder carcinoma; Leukoplakia of the bladder.

Case 6

Mrs. T. McD., widow, aged forty-four, referred by Dr. E. Spiegelberg. Admitted to the Presbyterian Hospital, December 23, 1925.

Previous history. Measles, mumps and scarlet fever during childhood.

Family history. One sister died of carcinoma of the uterus at the age of forty-four.

Present complaint. About two weeks before admission to the hospital the patient was suddenly seized with severe pain in the right upper quadrant. This was described as sharp in character. The pain remained localized and did not radiate. This attack lasted eight hours. The second attack of pain radiated from under the right costal margin to the back. A doctor was called who gave her morphine to relieve the pain.

Nocturia and frequency. Troubled with nocturia for about twenty years. At first the nocturia was once in a while, but at the present time she was obliged to urinate three or four times every night. Frequency during the day began three years ago and gradually increased. At the time of examination patient was obliged to urinate every two hours.

Pain in the bladder and urgency. Had a pain in her bladder, which was described as an aching pain, for many years and which was relieved always by urination. With this pain there was associated a certain amount of urgency of urination.

Physical examination. Pupils reacted to light and accommodation. Teeth showed many crowns. Tonsils negative. Neck negative. Heart and lungs negative. Examination of the abdomen showed some rigidity and a palpable mass in the right upper quadrant which was tender; there was some rigidity on the right side posteriorly. Reflexes normal.

Examination of blood. Red cells, 5,420,000; Leucocytes, 19,300; Hemoglobin, 90 per cent.

Blood pressure. Systolic 104, diastolic 62.

Roentgen-ray examination. Negative for stone.

Cystoscopic examination (sacral anesthesia, December 26, 1925, because of extreme irritability of the bladder). Flakes of pus adhering to the bladder mucous membrane; ureters normal.

Cystoscopic examination (sacral anesthesia, January 4, 1926). Considerable redness of trigone, flakes of pus sticking to trigone, right ureteral orifice gaping, the mucous membrane in region of the left ureter velvety. Both ureters catheterized without difficulty or obstruction. Urine from the right side was turbid with large flakes of pus. Urine from the left side was slightly turbid with specks.

Urinalysis (admission specimen). Reaction, alkaline; Albumin, +; Sugar, 0; Blood, 0; Bile +; Sediment; Leucocytes, +; many epithelial cells, many crystals.

Examination of catheterized specimens of urine. Bladder: Leucocytes per cubic millimeter, 520; Casts, 0; Cultures, b. coli; Smears for tubercle bacilli, negative. Right kidney: Leucocytes per cubic millimeter, 650; Casts 0; Cultures, B. coli; Smears for tubercle bacilli, negative. Left kidney: Leucocytes per cubic millimeter, 540; Casts, 0; Cultures, sterile; Smears for tubercle bacilli, negative.

Repeated examinations of urine were negative for tubercle bacilli.

Guinea-pig inoculations.

December 24, 1925. Bladder negative for tubercle bacilli. Right kidney negative for tubercle bacilli.

December 26, 1925. Bladder negative for tubercle bacilli.

December 31, 1925. Bladder negative for tubercle bacilli.

January 4, 1926. Bladder negative for tubercle bacilli. Right kidney negative for tubercle bacilli. Left kidney negative for tubercle bacilli.

Pyelograms. Normal.

Patient left the hospital on January 6, 1926, and returned on January 25, 1926. Complaints at this time were pain in the right side,

frequency of urination, pain on urination, feeling of fullness after eating, vomiting, jaundice, and pain in the epigastrium. These symptoms began shortly after she left the hospital.

Physical examination. The skin had a definite yellow tint and the sclerae of the eyes were yellow. The mass in the right upper quadrant was much larger and much more easily palpable.

Blood examination (January 25, 1926). Red cells, 3,500,000; Leucocytes, 25,000; Hemoglobin, 80 per cent.

Blood Wassermann test. Positive.

Patient was seen by Drs. Ralph C. Brown and D. B. Phemister.

Diagnosis. Carcinoma of the stomach with metastasis in the liver. Exploration advised.

Exploratory operation, February 8, 1926. By Dr. D. B. Phemister who found a carcinoma of the stomach with nodules in the liver and obstruction to the bile ducts.

The patient died, February 27, 1926.

Anatomical diagnosis. Adenocarcinoma of the gall bladder with extensive metastases to the liver; ascending cysto-uretero-pyelonephritis; leukoplakia of the urinary bladder; bilateral hydroureter and hydronephrosis. The lining of the urinary bladder is described as dark grey brown. About the trigone and extending up into the fundus along the lateral walls there are flat, irregular, slightly elevated whitish palpable plaques 1 to 3 or 4 mm. in diameter. Several of these small white plaques were removed for histological study.

Histological diagnosis: Leukoplakia of the urinary bladder; adenocarcinoma of the gall bladder with metastases to the liver.

Case 7

T. M., male, aged twenty, single. Referred by Dr. Dean Lewis. Admitted to the Presbyterian Hospital, July 3, 1923.

Present complaint. The patient stated that he had had more or less urinary distress for three years consisting of frequency, burning and pain on urination; also nocturia. Frequency was more marked at night than it was during the day. It gradually increased until he was obliged to void about every two hours during the day and during the night.

Hematuria. Began about two years ago and blood had been present in the urine from time to time.

Pyuria. Thought pus had been present in the urine practically all the time.

Physical examination. A well developed and well nourished male.

Head and neck negative. Heart and lungs, negative. Abdomen negative. External genitalia, negative. Extremities, negative. Several examinations for spinal cord lesions, negative. Rectal examination: a small prostate, margins of the left lobe hard, questionable for tuberculosis.

Blood examination. Leucocytes, 12,400; Hemoglobin, 90 per cent.

Blood chemistry. Blood sugar, 150; Urea, 65; Uric acid, 5.6; Creatinin, 3.2; Non-protein nitrogen, 60.

Urinalysis. Reaction, alkaline; Albumin, +++; Blood, +; Sugar, 0; Casts, 0; Sediments, leucocytes, epithelial cells, phosphates.

Residual urine. Amounts varied from 100 to 360 cc.

Cystoscopic examination (July 17, 1923). A large white area of leukoplakia was seen around the internal urethral orifice, beginning above and extending to the right side about half way down to the base.

Examination of catheterized specimen of urine (July 17, 1923). Bladder: (Leucocytes per cubic millimeter, 840; Cultures, sterile; Casts, 0; Tubercle bacilli, negative.

Repeated examinations of bladder urines were negative for tubercle bacilli.

Guinea-pig inoculations.

July 25, 1923. Bladder positive for tubercle bacilli.

July 27, 1923. Bladder positive for tubercle bacilli.

Examination of catheterized specimen, August 28, 1923. Bladder positive for tubercle bacilli.

Diagnosis. Leukoplakia of the bladder; Renal tuberculosis.

Patient died in March, 1924, of uremia. Unfortunately, an autopsy could not be obtained.

Case 8

I. M. B., male, aged thirty-four. Admitted to the Presbyterian Hospital, November 27, 1927.

Previous history. Gonorrheal infection five years ago, complicated with gonorrheal rheumatism.

Present illness. This began July, 1927, when the patient acquired a gonorrheal infection. Several weeks subsequently epididymitis developed, at which time burning on urination, great frequency of urination, nocturia occurred. Pus in the urine and almost constant dribbling. The burning was most marked along the urethra. The acute symptoms soon subsided and irrigation and massage of his prostate were instituted.

Hematuria. In November this complication developed and large

clots were passed. The urine was decidedly turbid and had a foul odor.

Physical examination. Head and neck, negative. Tonsils, moderately enlarged. Lymph glands in neck, palpable. Thyroid, negative. Heart and lungs, negative.

Abdominal examination. Negative. External urethral orifice showed no urethral discharge. There was enlargement and some tenderness involving the right epididymis. Left cord, slightly enlarged and tender.

Rectal examination. Margins of right lobe easily felt. Margins of the left lobe could not be outlined, as they fused with the bony pelvis. Left seminal vesicle was exceedingly hard and broad and seemed to be in one mass with the prostate. Right seminal vesicle, soft. Strippings from the prostate showed a few gonococci.

Treatment consisted of Sitz baths, internal medication and sedatives. Condition unimproved, and on account of the unfavorable state of patient's health he was sent to the Presbyterian Hospital.

Blood chemistry, December 10, 1927. Urea, 10.5; Uric acid, 4.1; Creatinin, 1.5; Non-protein nitrogen, 27.8.

Blood examination. Red cells, 4,390,000; Leucocytes, 13,250; Hemoglobin, 80 per cent.

Blood Wassermann. Negative.

Blood pressure. Systolic 138, diastolic 108.

Examination catheterized bladder urine (December 6, 1927). Leucocytes per cubic millimeter, 79,000; Cultures, sterile; Tubercle bacilli, Negative.

Cystoscopy (under deep ethylene anesthesia, December 7, 1927). Severe generalized cystitis. Some bleeding from the neck of the bladder. Interureteric ligament markedly hypertrophied and at the base of the bladder multiple areas of ulceration and a large median bar. Both ureters were catheterized without difficulty or obstruction.

Examination of catheterized urines. Bladder: Leucocytes per cubic millimeter, 27,200; Smears, no organisms; Cultures, sterile. Right kidney: Leucocytes per cubic millimeter, 40; Smears, no organisms; Cultures, sterile. Left kidney: Leucocytes per cubic millimeter, 10; Smears, no organisms; Cultures, sterile.

Pyelograms. Left kidney, a bifid pelvis. Lower end of ureter dilated. Right kidney, normal.

Upon failure to obtain relief through the usual forms of treatment, a suprapubic cystotomy was advised. Operation performed, December 14, 1927. The bladder wall was exceedingly thick. The mucous mem-

brane over the trigone was markedly hypertrophied, thick and granular. Around the neck of the bladder was seen an area of ulceration that completely surrounded the internal urethral orifice and which bled very easily. The bladder neck was exceedingly tight and a definite median bar was seen. On the posterior wall there was an ulcer about 2½ inches long and two white areas of leukoplakia.

Diagnosis. Median bar hypertrophy with contracture of internal urethral orifice; Ulcerative cystitis; Leukoplakia of the bladder; Bifid kidney pelvis (left).

Case 9

Mrs. R. S., aged fifty-three, referred by Dr. D. B. Phemister. Admitted to the Presbyterian Hospital, January 27, 1926.

Family history. Negative. Patient had been married nine years and had never been pregnant.

Present complaint. Eleven years before admission to the hospital patient began to have frequency of urination accompanied by a marked urgency and some incontinence. The condition remained about the same and several years later she began to notice that some of her urine appeared cloudy. Passage of urine was accompanied with a burning sensation. For this she had bladder lavage for two of three years with some improvement. Pain in the left renal area started in 1923 and radiated along the course of the left ureter. It was sharp and cutting and interfered with the patient's sleep. Was obliged to urinate every ten or fifteen minutes during the day and four or five times at night and sometimes more often than this.

Physical examination. Head and neck, negative. Heart and lungs, negative. Examination of the abdomen, negative.

Blood examination. Leucocytes, 11,100; Hemoglobin, 88 per cent.

Blood pressure. Systolic 104, diastolic 70.

Roentgen-ray examination. Negative for stone.

Urinalysis. Reaction, acid; Albumin, +++; Sugar, 0; Blood, +++; Pus, ++.

Phthalein test. Output of 55 per cent in one and one-half hours. Time of appearance five minutes.

Cystoscopic examination (January 28, 1926). A large dull white area extending from in front of the air bubble above to or nearly to the internal urethral orifice below, about the size of a silver dollar and wedge-shaped in outline. The margins of the mucous membrane of the bladder were hyperemic. A similar area was seen on the trigone in front of the

right ureteral orifice. Ureters were catheterized without difficulty or obstruction.

Examination of catheterized specimens of urine. Bladder: Leucocytes per cubic millimeter, 1240; Cultures, B. coli; Tubercle bacilli, negative. Right kidney: Leucocytes per cubic millimeter, 5; Cultures, B. coli and hemolytic streptococci; Tubercle bacilli, negative. Left kidney: Leucocytes per cubic millimeter, 5; Cultures, B. coli; Tubercle bacilli, negative.

Guinea-pig inoculations. Bladder, negative for tubercle bacilli. Right kidney, negative for tubercle bacilli. Left kidney, negative for tubercle bacilli.

Cystoscopic examination (February 2, 1926). A second cystoscopic examination was undertaken to verify the previous findings. The result of this examination verified the first examination. At this time, however, two ureteral openings were found on the left side, one of which had been overlooked at the first cystoscopic examination. The two left ureters were catheterized with the following result: Lower left kidney: Leucocytes per cubic millimeter, 0; Cultures, sterile; Tubercle bacilli, negative. Upper left kidney: Leucocytes per cubic millimeter, 1; Cultures, sterile; Tubercle bacilli, negative.

Guinea-pig inoculations (February 1, 1926). Lower left kidney, negative for tubercle bacilli. Upper left kidney, negative for tubercle bacilli.

Pyelogram (February 1, 1926). A double kidney pelvis and double ureters on the left side, otherwise negative.

Diagnosis. Leukoplakia of the bladder; Double kidney pelvis and double ureters (left).

Case 10

Mr. C. W., aged forty-eight, referred by Dr. W. E. Post. Admitted to the Presbyterian Hospital, November 30, 1923.

Previous history. Negative except for a gonorrheal infection twenty years prior to examination.

Present complaint. One year ago, November, 1922, patient consulted a physician for so-called rheumatism. He was told that his rheumatism was due to an infected diverticulum of his bladder. In June, 1923, this diverticulum was removed after which the rheumatism improved.

Frequency of urination. After the operation patient was troubled with frequency of urination which gave him a good deal of distress. At times he was obliged to void every fifteen minutes during the day and three times at night.

Hematuria. After his diverticulectomy he noticed hematuria and stated that before his operation he had never seen any blood in the urine. Associated with frequency and hematuria there was burning and smarting at the beginning and ending of urination. This sensation extended from the tip of the penis to the anus.

Weakness. Unable to work much since operation on account of weakness.

Loss of weight. About 35 pounds since the operation.

Rheumatic pains. He also complained of rheumatic pains in hips, knees, back and shoulders.

Physical examination. Head and neck, negative. Pus in both tonsils. Heart and lungs, negative. Examination of the abdomen showed a scar above the symphysis pubis, otherwise negative. External genitalia, negative.

Rectal examination. A very large, hard and firm prostate. Massage showed pus and cultures showed streptococci. No residual urine upon examination.

Blood examination. Red cells, 5,346,000; Leucocytes, 6,600.

Blood pressure. Systolic 100, diastolic 72.

Blood Wassermann test. Negative.

Roentgen-ray examination. Teeth showed apical abscesses. The genito-urinary tract negative for stone.

Urinalysis. Turbid; specific gravity, 1012; Reaction, alkaline; Albumin, +; Blood, +; Sugar, 0; Sediment, pus ++ and epithelial cells ++.

Cystoscopic examination (December 7, 1923). Two areas of *Leukoplakia on the anterior wall and on the left lateral wall.* A moderate amount of cystitis. Both ureters were catheterized without difficulty or obstruction.

Examination of catheterized specimen of urine. Bladder: Cultures, B. coli.

Smear made from caseous material obtained at the time of cystoscopic examination showed no tubercle bacilli or other organisms.

Examination of catheterized specimens of urine. Bladder: Leucocytes per cubic millimeter, 510; Cultures, Streptococci; Tubercle bacilli, negative. Right kidney: Leucocytes per cubic millimeter, 0; Cultures, sterile; Tubercle bacilli, negative. Left kidney: Leucocytes per cubic millimeter, 40; Cultures, Streptococci; Tubercle bacilli, negative.

Repeated examinations of urine were negative for tubercle bacilli.

Guinea-pig inoculations (January 19, 1924). Bladder, negative for

tubercle bacilli. Right kidney, negative for tubercle bacilli. Left kidney, negative for tubercle bacilli.

Pyelograms. Normal.

Two subsequent cystoscopic examinations yielded essentially the same findings as the first examination. With a cystoscopic rongeur a piece of tissue was removed for histological study and this showed the presence of *leukoplakia.*

Diagnosis. Diagnosis of leukoplakia was made with the cystoscope and verified with a histological study of sections.

Case 11

Mrs. I. O'B., aged thirty-four, married. Admitted to the Presbyterian Hospital, April 14, 1926. Two children living and well.

Previous illness. Usual diseases of childhood.

Family history. Father died of cardiorenal disease at seventy-four and mother died of a paralytic stroke at fifty-three, otherwise family history was negative.

Present complaint. Present illness began a year ago when patient noticed burning on urination just before the act was finished. The burning increased in severity so that at the time of examination it was continuous. For this she had had some treatment which failed to give relief.

Frequency of urination. Began with the burning; every thirty minutes; in easier periods, every two to four hours.

Nocturia. Past two years; first year, once or twice during the night; second year, three or four times during the night.

Urgency. Present for a year and when desire came had to respond immediately.

Hematuria. About ten months ago noticed blood at the end of each urination. The urine was not dark, therefore the blood must have been fresh. No such manifestation since.

Physical examination. An undernourished female who was very pale. Tonsils had been removed but part of the right tonsil remained. The mucosa of the mouth was pale and the gums bled easily. Head and neck, negative. Heart and lungs, negative. Some rigidity and tenderness in the right upper quadrant. Left kidney and spleen, not palpable. A rigid mass could be felt in the right flank.

Rectal examination. Negative.

Vaginal examination. Uterus enlarged and third degree retroversion, otherwise negative.

Blood examination. Red cells, 4,150,000; Leucocytes, 14,500; Hemoglobin, 78 per cent.

Blood pressure. Systolic 102, diastolic 78.

Blood chemistry. Urea, 13.66; Uric acid, 2.42; Creatinin, 1.20; Nonprotein nitrogen, 33.32.

Urinalysis. Reaction, acid; Albumin, ++; Sugar, 0; Blood, ++; Pus, ++++; Casts, 0; Sediment, few red blood cells and motile bacilli.

Examination of catheterized bladder urine. Leucocytes per cubic millimeter, 16,121; Cultures, B. coli; Tubercle bacilli, negative.

Thalein test (time of appearance five minutes): First 30 minutes, 35 per cent; second 30 minutes, 20 per cent; third 30 minutes, 5 per cent; total output for 1½ hours = 60 per cent.

Roentgen-ray examination of chest. Negative.

Cystoscopic examination, April 14, 1926. Bladder capacity limited. Right ureteral orifice, normal; left ureteral orifice, retracted. To the right of left ureteral orifice an area of ulceration. Right side catheterized; impossible to catheterize left side.

Examination of catheterized specimens of urine. Bladder: Leucocytes per cubic millimeter 8000; Casts, 0; Gram smear, no organisms; Cultures, sterile; Tubercle bacilli, negative. Right kidney: Leucocytes per cubic millimeter, 2; Casts 0; Gram smear, no organisms; Cultures, sterile; Tubercle bacilli, negative.

Examination of centrifuged bladder urine, April 15, 1926. Tubercle bacilli found.

Guinea-pig inoculation, April 14, 1926. Bladder: *positive for tubercle bacilli.* Right kidney, negative for tubercle bacilli.

Guinea-pig inoculation, April 26, 1926. Bladder: *positive for tubercle bacilli.* Right kidney, negative for tubercle bacilli.

Operation (April 29, 1926). Left nephrectomy. Description of the kidney showed two large abscessed cavities filled with pus. These were about three centimeters in diameter. In the pelvis at the level of the middle calyx, an area *of leukoplakia about 2 cm. in diameter.* The epithelium scales in white, thin flakes. At the junction of the lower and middle thirds, an area of multiple tubercle formation extending from the pelvis clear through to the outer side of the kidney. Ureter, dilated and thickened. The ureteral mucous membrane, studded with miliary tubercles. The abscessed cavities, rigid and thick, indicating that the cavities were old.

Patient had an uneventful convalescence and was discharged from the hospital, May 11, 1926.

Diagnosis. Tuberculosis of the left kidney; Leukoplakia of the left kidney pelvis.

Case 12

H. S., male, aged forty-one, single. Patient was seen at the United States Veterans' Hospital No. 76, January 30, 1923.

Previous history. The patient had been operated upon some time previous for multiple calculi of the urethra. Venereal disease denied. About five years before coming under observation began to complain of frequency of urination, burning, tenesmus and turbid urine containing flakes. This condition remained unchanged for about two years. Obtained some relief with bladder irrigations. Had passed blood in the urine which he said looked like old clots.

About three years before coming under observation, began to have definite cramp-like pains in the left loin and flank, much burning, frequency, nocturia and tenesmus. Two years ago, was unable to pass more than a few drops of urine at a time and this condition persisted for five days. On examination a large calculus was found in the anterior urethra and later two more were found in the posterior urethra and two in the bladder. These were removed by surgery.

Present complaint. Frequency of urination, present for four years. Was obliged to urinate every one and one-half hours during the day and three times at night.

Cloudy urine. Stated that his urine had been cloudy for the past five years and had never wholly cleared up.

Pain. Pain in the left loin and flank daily for four months; never extended below the umbilicus. Began about 3:00 a.m. and persisted until patient got up.

Physical examination. Pupils reacted to light and accommodation. Tonsils small. Teeth, in good repair. Neck, negative. Lungs, negative. Heart: apex inside the nipple line. Slight systolic thrill over apex and accentuation of the second sound. Abdominal examination, negative. External genitalia, negative. Rectal examination, negative.

Blood chemistry. Urea nitrogen, 26.0; Uric acid, 2.2; Creatinin, 1.5.

Blood pressure. Systolic 118; diastolic 82.

Wassermann test. Negative.

Roentgen-ray examination. Shadow in region of left kidney compatible with stone.

Urinalysis. Color, straw; Specific gravity, 1020; Albumin, +; Blood, +; Sugar, 0; Sediment, pus +++, Red blood cells +++, triple phosphates.

Phthalein test, February 8, 1923.	*Right*	*Left*
Time of appearance	6 minutes	faint
First 30 minutes	15 per cent	5 per cent
Second 30 minutes	5 per cent	0
Total, 1 hour	20 per cent	5 per cent

Cystoscopic examination (February 19, 1923). Mild generalized cystitis. Ureters catheterized without difficulty or obstruction. Clear urine obtained from the right ureter and thick foul urine from the left ureter.

Examination of urine obtained at the time of the cystoscopic examination showed the following: Bladder: Pus cells, many; Cultures, B. coli; Albumin, +; Red blood cells, +; Tubercle bacilli, negative. Right kidney: Pus cells, occasional; Cultures, sterile; Albumin, +; Red blood cells, +++; Tubercle bacilli, negative. Left kidney: Pus cells, many; Cultures, B. coli; Albumin, +; Red blood cells, +; Tubercle bacilli, negative.

Phthalein test, March 3, 1923.	
First hour	17 per cent
Second hour	20 per cent
Total, 2 hours	37 per cent

Pyelograms. Right side normal. Left side showed dilatation of the ureter. Kidney pelvis normal in size but atypical in shape. Calyces enlarged and irregular in outline.

Operation, March 27, 1923. Left nephrectomy. Kidney showed much retraction and scar formation. The perinephritic fat, dense and adherent. About ¾ inch below the lower border of the kidney, a stricture of the ureter, above which the pelvis is dilated. In the lower pole of the kidney, a large cavity which contained a single stone (fig. 2). Pelvis and lower pole filled with a very large stone. The mucous membrane of the pelvis was red, swollen and edematous, smooth and glistening and showed many small granular spots, standing out in marked contrast to the mucous membrane of the superior calyces and lower part of the pelvis. This section of the mucous membrane has a dull china-white color, is smooth, without luster and appears very dull and extends to the large cavity from which the stone was removed, but not into it.

The patient made an uneventful convalescence.

Diagnosis. Stricture of the ureter; Hydronephrosis (infected); Stone in the kidney; Leukoplakia of the kidney pelvis.

Case 13

F. D. B., male, aged sixty-one, referred by Dr. D. B. Phemister. Admitted to the Presbyterian Hospital, January 18, 1925.

Family history. Negative.

Previous illness. Negative. Six weeks before coming to the hospital patient had all his teeth extracted on account of infection.

Present illness. Patient stated that his present illness began about thirty-five years ago, at which time he had a severe attack of renal colic which was associated with the passage of gravel. He has passed stones many times since and has had repeated attacks of renal colic. The last attack occurred one year ago.

Frequency. Patient obliged to urinate about nine times during the day and twice during the night. Frequency of urination was associated with persistent burning and some pain.

Pyuria. Patient stated that he had thick pus in his urine. No bladder symptoms.

Physical examination. Patient was well developed and nourished. Head and neck, negative. Heart and lungs, negative. Liver, spleen and kidneys, not palpable. No tenderness over the kidney region nor over the bladder area. External genitalia, negative. Reflexes normal.

Rectal examination. Moderate hypertrophy of the prostate.

Blood examination. Red cells, 4,560,000; Leucocytes, 11,000; Hemoglobin, 85 per cent.

Blood pressure. Systolic 122, diastolic 64.

Blood chemistry. Urea, 40; Uric acid, 4; Creatinin, 1.25; Non-protein-nitrogen, 37.

Blood Wassermann test. Negative.

Urinalysis. Cloudy; Reaction, alkaline; Albumin, ++; Sugar, 0; Blood, 0; Pus, ++; Casts, 0; Sediment, phosphates.

Phthalein test.	*Right*	*Left*
Time of appearance	0	7 minutes
First 10 minutes		3 per cent
Second 10 minutes		8 per cent
Total 20 minutes		11 per cent

Roentgen-ray examination. Negative for stone.

Cystoscopic examination (January 23, 1925). Mild generalized cystitis

and a definite median-bar formation. Both sides catheterized without difficulty or obstruction. Urine from the left side, clear; from the right side, cloudy.

Pyelogram. Right pyelogram showed a very large hydronephrosis.

Examination of catheterized urines. Bladder: Leucocytes per cubic millimeter, 3260; Cultures, B. coli; Smears for tubercle bacilli, negative. Right kidney: Leucocytes per cubic millimeter, 2,400; Cultures, B. coli; Smears for tubercle bacilli, negative. Left kidney: Leucocytes per cubic millimeter, 40; Cultures, sterile; Smears for tubercle bacilli, negative.

Guinea-pig inoculations (January 23, 1925). Bladder, negative for tubercle bacilli. Right kidney, negative for tubercle bacilli. Left kidney, negative for tubercle bacilli.

Cystoscopic examination (January 26, 1925). Verified the previous findings.

Guinea-pig inoculations (January 26, 1925). Bladder, negative for tubercle bacilli. Right kidney, negative for tubercle bacilli.

Operation, February 11, 1925. Right nephrectomy. Description of kidney: Kidney and ureter weighed 105 grams and capsule stripped easily. Cortex of kidney, average thickness 0.5 cm., light brown in color. Pelvis of kidney, dilated. Calyces, broad and dilated. The epithelium lining the pelvis is blue gray color, (fig. 3), thickened 1 mm. in patches, longitudinal wrinkles and folds, and the inferior calyx is entirely lined with the thickest patch. The middle and superior calyces are lined with slightly thinner patches of epithelium. The ureteropelvic junction and part of the pelvis is thinner and more of an orchid color, and there are patches from 3 to 7 mm. in diameter in the pelvis. This leukoplakia extends down the ureter 13.5 centimeters.

Diagnosis. Hydronephrosis (infected); Leukoplakia of kidney pelvis and ureter.

Patient made an uneventful recovery and was discharged from the hospital, February 27, 1925.

SUMMARY

1. Leukoplakia of the urinary organs probably occurs more frequently than we believe.

2. It may occur in the presence of various lesions of the urinary tract such as stone, infection and tuberculosis. In some cases it occurs without the presence of these co-existing diseases and is the only lesion found.

3. Because of the various types of organisms found, the causal relationship between the two is not yet determined.

4. In this series the ratio between male and female is 2:1.

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DISCUSSION

Dr. EDWARD L. KEYES (New York): I wish to report a case of urethral leukoplakia seen by me shortly after 1900 at the time when Dr. Abby was the only person in New York who had any radium. This was an extensive leukoplakia, maybe an inch and a half long, on the roof of the urethra at about the penoscrotal angle. It seemed quite impractical to attack it by surgery.

Dr Abby applied radium but as the patient lived out of town, the applications were very irregularly made. I do not know the number of treatments that were given. The result of treatment was to obliterate about half the area of leukoplakia; the other half has persisted ever since. I saw the patient last within the past two years. It is over twenty years since I first saw him. Every time I see him I urethroscope him. The lesion looks about the same since the last time the radium was applied, which was certainly fifteen years ago, and there is no evidence as yet that he is getting any tumor. He refuses any further treatment.

Dr. FRANCIS R. HAGNER (Washington): I just want to report a case of leukoplakia of the bulbus urethra that occurred in a man following stricture. I had this man under observation for about three or four years. I tried to get rid of him; I told him I could not do anything for him. He had no symptoms except large shreds in the urine; with the urethrosocope he has the appearance as described. I have used radium on him and it has not done any good at all. His leucoplakia is still present. It extends for nearly an inch along the bulbus urethra.

Dr. VINCENT J. O'CONOR (Chicago): I would like to mention 3 cases of leukoplakia which I think are of interest. The first patient, a woman past sixty-five years of age, had a closed off pyonephrosis on the left side, with a normally-functioning kidney on the right.

I did a left nephrectomy about four years ago. It was a very striking picture when the kidney was split open. Not having seen a leukoplakia of the kidney pelvis before, I took the specimen over to Dr. Kretschmer and he was very much interested in it and he said it was undoubtedly a good example of complete leukoplakia of the pelvis and ureter. At the point where I had divided the ureter, the leukoplakia continued; in other words, I divided the ureter about two inches below the uretero-pelvic junction and the leukoplakia ran continuously to that region. The urine cultures were negative for tubercle bacilli. Profuse growth of colon bacilli from both bladder and left kidney. They were repeated several times. I saw her for a period of about two years and did not see her again until last week when her son brought her to the office saying that she was urinating every ten or fifteen minutes, her life was unbearable and she was in a very bad physical condition. Her bladder capacity at this time was only about an ounce or an ounce and a half. It was impossible to cystoscope her or even catheterize her bladder. She was a Jewish woman and very intolerant. On cystoscopy the other day, under gas anaesthesia, I found a complete leukoplakia of the floor of the bladder. Two years ago there was absolutely no leukoplakia obvious in the bladder. I had cystoscoped her a number of times. She has infection in the right kidney with considerable destruction and I think that this case is exceedingly interesting from the standpoint of the possibility of contiguity; at any rate, the leukoplakia appears to come down from the left ureter opening and involves the trigone.

The second case was a man past fifty, who had a suprapubic prostatectomy several years before. Bladder symptoms continued for two years. He had two ounces of residual urine. On cystoscopy we found a leukoplakia area involving the apex of the trigone. He also had what appeared to be a median bar. I operated suprapubically and removed the bar and because of the extensive involvement of the trigone, I merely cauterized the trigone with the actual cautery. The patient did not do well. His residual urine was relieved but later on cystoscopy he had an area of leukoplakia over the trigone. I operated on him a third

time and this time removed practically the entire area with the electrocautery. The patient immediately healed up, his bladder symptoms disappeared and he is absolutely well. Cystoscopy shows a normal bladder floor. The third patient is one with spinal bladder following traumatic injury in whom I observed leukoplakia over a period of a year and a half and later I noticed he was developing ulceration in the previous area of leukoplakia. I believed there was early malignant degeneration taking place. I advised operation and removed the area suprapubically again with electrocautery, and this showed no malignancy. This area has completely healed and at this time, two years since operation, there is no sign of recurrence.

Dr. BENJAMIN S. BARRINGER (New York): I had a patient in whom I removed by radium, a papillary carcinoma of the bladder neck. It was fairly easily removed and at the end of four and one-half years, in the regular routine of cystoscopy, she showed a leukoplakia of precisely the same area where the tumor was. There is no malignant degeneration and that is being treated by radiation.

The case Dr. Kretschmer reported of Dr. Briggs was treated by me by the application of unscreened radium to the leukoplakia. Unscreened radium is the thing I think you need. I think you want a cauterizing effect rather than the gamma-rays alone. This patient had a good deal of reaction but Dr. Briggs finally reported her as cured.

Dr. HERMAN L. KRETSCHMER (closing): I just wish to say a word regarding Dr. O'Conor's very interesting report. Apparently under his very eyes this leukoplakia has gone on, illustrating one possible course of events in these cases, whereas Dr. Keyes told us he had been watching Dr. Abby's case for many years and the thing seems to remain in the same status. I think that is a very interesting observation of Dr. O'Conor's. I saw the specimen. It is a beautiful specimen. I think he ought to write it up.

EXTRAVESICAL TUMORS IN THE MALE CAUSING INTERFERENCE WITH URINATION

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The numerous physiological and pathological conditions causing generalized or circumscribed enlargements of the uterus, together with its close anatomical relationship to the urinary bladder leads to many instances of interference with the normal function of urination in the female. In the male however, extravesical masses are less frequently encountered, if the literature, or personal experience, is any criterion of the incidence of this condition.

In this connection, the only fixed or partially fixed structures which might become so involved are the seminal vesicles and the bony pelvis. It is understood that the loose areolar tissues as well as the fat immediately surrounding the bladder may become primarily involved to form such masses. While secondary involvement of the seminal vesicles by cancer from the prostate and occasionally from the rectum is not infrequent, primary growths of these structures must be relatively rare. A few authentic cases of primary carcinoma as well as sarcoma of the seminal vesicles and one instance of fibromyoma have been recorded in the literature.

We wish to put on record two instances of extravesical tumors, the chief symptoms of both being urinary.

Case 1

A male, aged fifty-seven, was admitted to the hospital March 28, 1927, with a working diagnosis of hypertrophy of the prostate. His chief complaints were frequency of urination both day and night for the past three years, which symptom was gradually progressing. Pain in the left hip which radiated into the thigh at times, was a pronounced feature

*By invitation.

of his complaint. It had been present for three years. He had lost 20 pounds of weight during this time.

Physical examination revealed a slender white male with a drawn painful expression of his face. There was tenderness along the left sciatic nerve and moderate stiffness of the left hip joint. The heart was slightly enlarged and had a soft transmitted systolic blow over the apex. The temperature was normal.

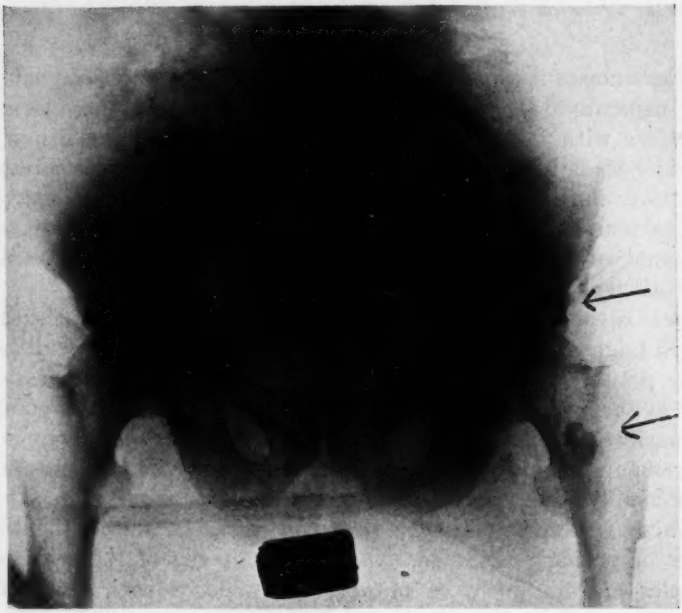

FIG. 1. PLAIN X-RAY PLATE OF PELVIS OF CASE 1 SHOWING SUSPICIOUS AREAS INDICATED BY ARROWS

Rectal examination found the lateral prostatic lobes only slightly enlarged, if at all, while the left lobe gave a sensation of fixation as compared with the opposite side. There was one ounce of clear residual urine.

X-ray plates of the pelvis and long bones for metastases drew the following report from the roentgenologist: "There is an indefinite density

below the right sacro-iliac presumed to be arterio-sclerotic. A density below and external to the lower extremity of the left ilium showed sclerosis suggestive of malignant or carcinomatous prostatic metastatic pathology, although such is not commonly unilateral. An enlarged well defined density or compact island was present in the intertrochanteric region of the left femur. Appearances presume small destructive foci

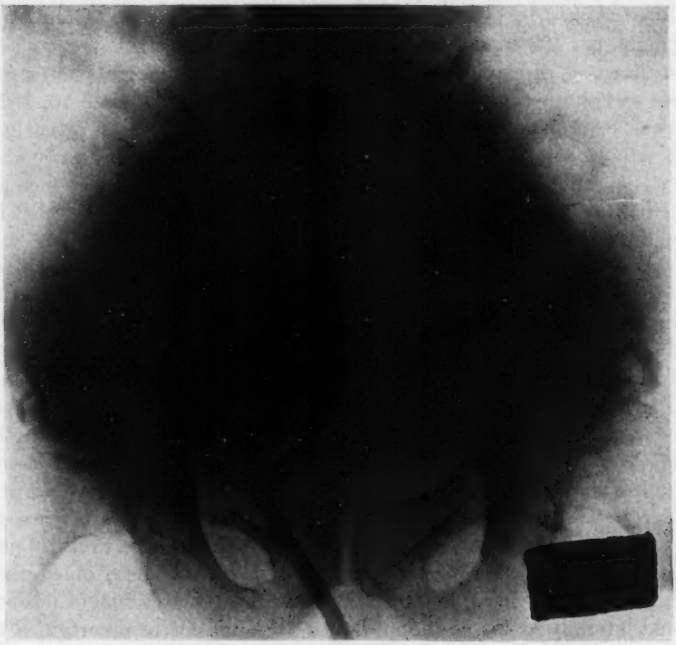

FIG. 2. CYSTOGRAM OF CASE 1 SHOWING MALPOSITION OF DISTENDED BLADDER

above the outer extremities of both acetabula (see fig. 1). The lungs were negative. The lumbar spine presented an osteo arthritis."

Cystoscopic examination on April 2, 1927. A No. 24 cystoscope was passed with considerable difficulty due to a left sided bulging at the vesical neck which caused a marked lateral displacement of the instrument. The mucosa presented a picture of moderate chronic hyperaemia and trabeculation. There was no ulceration or evidence of malignancy of

the bladder or prostate. There was intravesical protrusion of the entire left lateral wall including the base, to such an extent that the left ureteral orifice appeared to the right of the midline (fig. 2).

Laboratory data. The blood picture was that of a low grade secondary anaemia. The urine contained pus 2 and an occasional hyaline cast.

Phenolsulphonephthalein intravenously given returned 55 per cent in the first hour and 8 per cent in the second hour.

Blood chemistry. Urea, 38.9 mgm. per 100 cc. of blood. Creatinine, 1.6 mgm. per 100 cc. of blood.

A diagnosis of carcinoma of the prostate with bone metastases was made and the patient was sent home as inoperable, on April 16, 1927. He was readmitted June 6, 1927 because of acute urinary retention. The retention was relieved by catheter once, after which he urinated spontaneously, but with great difficulty. There was a gradually increasing edema of the left thigh and leg. It was therefore concluded that he should have a permanent suprapubic fistula.

Operation, September 30, 1927. Under caudal and abdominal block anesthesia a suprapubic incision revealed the presence of a solid smooth tumor firmly fixed between the pelvic wall and the distended bladder. The consistency of this mass was firm but not hard, the anterior aspect was grayish yellow in color and apparently about the size of the distended bladder. By further freeing the tumor, it was found to be readily separated from the bladder down to the base, while laterally it appeared to be firmly fixed to the inner aspect of the body of the ischium and ilium and extended medially to be firmly adherent to the upper part of the left border of the sacrum. The entire mass was entirely extra-peritoneal. To more accurately determine its extent medially, the peritoneum was opened and the pelvis explored. It was definitely determined that the growth was firmly fixed to the sacrum, but the attachment did not extend laterally as far as the midline. It could not be ascertained to what extent, if any, it involved the lower sacral segments or the coccyx.

The mass was incised, to obtain a biopsy specimen. The incision was through a dense wall one centimeter thick which opened into a collection of gelatinous material which was odorless and contained various sized whitish granules which felt hard and rough. Upon exploring the cavity it was found to contain hard and sharp masses which projected into the cavity from the inner wall. These gave to the exploring finger the sensation of touching and breaking small icicles.

The bladder was opened and found to be essentially normal, excepting for its position in the right side of the pelvis. The vesical neck was

normal, there being no evidence of prostatic change, either benign or malignant.

A permanent bladder fistula was made and the perivesical spaces adequately drained.

Microscopic sections showed islands of normal cartilage cells with a few small areas of calcification. The remaining portion consisted of fatty and dense fibrous tissue with some round and plasma cell infiltration. The pathologist ventured a diagnosis of enchondroma (fig. 3).

The postoperative course has been uneventful, but the growth

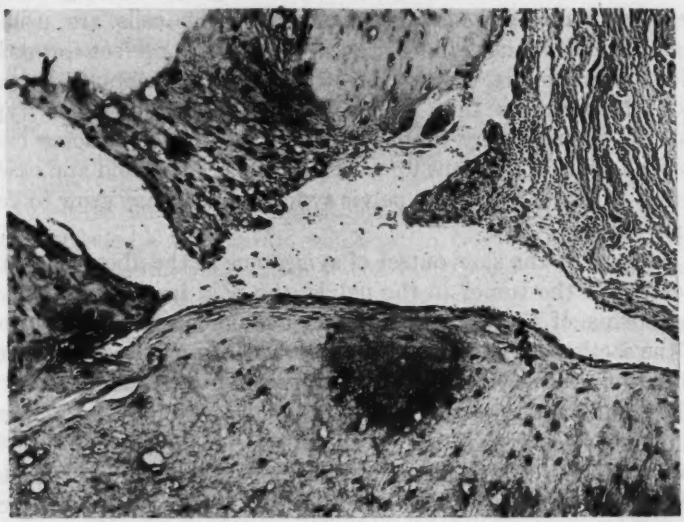

FIG. 3. PHOTOMICROGRAPH (× 150) SHOWING ISLANDS OF CARTILAGE CELLS SURROUNDED BY A FIBROUS AND FATTY TISSUE MATRIX

is gradually progressive, since it can now be readily palpated suprapubically and rectally, the pain is more severe and he now requires sedatives regularly. A recent roentgenogram of the pelvic bones gives a picture not unlike the one seven months previously, the roentgenologist now interprets the changes as probably due to a low grade infective process.

Outside of a general dullness over the region of the tumor there is no local X-ray finding.

Ewing (2) states that the true chondroma is a rather common tumor of cartilage cells, encased in a firm matrix, having rather active proliferative powers. It produces a hard, rounded, lobulated tumor which often reaches large dimensions. Most of these tumors are solid, but may become softened by mucinous degeneration, and cysts filled with mucinous, serous or fatty material may form. Although usually localized and benign, they sometimes grow extensively. In structure the cartilage cells vary greatly in size and usually lack the orderly arrangement into groups of cells with opposed surfaced flattened. The cells are usually rounded and lie in distinct spaces, but with imperfect formation of chondrin matrix, they become stellate with mucinous degeneration, fusiform as they approach the connective-tissue type, calcific granules may be deposited in them, and in some cases they show all transitions up to the bone cell in osteoid and osseus areas. Chondromas from pelvic synchondroses may grow to very large size.

Because of the slow outset of symptoms in the above case, the location of the tumor in the pelvis, the pain in the hip and leg, the edema of the limb, the suspicious microscopical appearance of the section of the tumor and the slow course of the pathological condition since coming under observation, one should keep in mind that the above tumor may be a chordoma. Chordomas are tumors of remnants of the chorda dorsalis, the embryonal tissue about which the spinal column develops. Some grow into the pelvis interfering with the functions of the bladder and rectum and always with pain from erosion of bone and infiltration of nerve trunks. Their usual and early structure resembles hyaline cartilage but without intercellular substance. The cells are large, rounded, vacuolated, hyperchromatic and may resemble epithelium. Much mucinous material may distend the cells and infiltrate the invaded tissues. Cases with similar symptoms and findings have been reported by Ewing (3), Debanardi and Albert (4), Lewis (5), and Stewart (6). However, as yet, there is no evidence of any external sacral tumor or destructive tendency toward surrounding bones, in our cases. Until the source of this tumor can be definitely determined we feel that it must be classifed as an enchondroma.

Case 2

A male negro age fifty, was admitted to the hospital October 23, 1926, with an admitting room diagnosis of suspect carcinoma of the prostate gland. He complained of pain over the left lumbar region and frequency of urination, both of two months' duration. His frequency was more marked during the daytime. There was no dysuria. There had been no hematuria or passing of gravel. He had lost no weight and his appetite was good. Constipation had been so marked that the patient had the catharsis habit.

The patient stated that he had gonorrhea and syphilis at the age of twenty-five. He has had no antiluetic treatment.

Physical examination was essentially negative except for a slight mucoid discharge from the urethra and a large irregular mass in the region of the left seminal vesicle and lateral thereto. There was distinct tenderness over this area. The stained urethral smear proved to be mucus.

The urine contained clumps of pus cells. Urinary antiseptics had little effect on a temperature which varied from 99° to 101°F. The white blood count varied from 15,000 to 20,000. The Wassermann and Kahn reactions on the blood were negative.

Cystoscopic examination. A No. 21 F. instrument passed unobstructed. There were eight ounces of milky urine in the bladder. The left side of the bladder cavity was encroached upon to cause bulging inwardly; this area was hyperaemic, the left ureteral orifice was elevated and red. The remainder of the bladder mucosa appeared mildly hyperaemic. The right ureteral orifice was not pathological; a catheter passed readily and a clear specimen of urine was caught for study. It was impossible to pass a catheter up the left ureter more than half an inch. Intravenous phenolsulphonephthalein appeared from the right kidney in five minutes in very good concentration. A plain X-ray plate showed the right catheter to extend to the level of the lower border of the first lumbar vertebra and deflected markedly to right in its course through the bladder region; there were no other significant shadows throughout the abdominal or pelvic regions.

The right kidney urine contained a few pus cells but was sterile to culture; a guinea pig inoculation was negative for tuberculosis.

A chest X-ray plate revealed an old calcification bead of six millimeters in the right hilum, and a slightly larger one just superior to this. There was slight veiling of the apices but no tuberculous mottling.

There was no evidence of tumor metastases. X-ray pictures of the large and long bones were negative for pathology.

FIG. 4. INDICATING COURSE AND DIRECTION OF LEFT URETERAL CATHETER WHICH IS ON THE RIGHT SIDE OF THE MID-LINE AT THIS LEVEL. THE RIGHT CATHETER TAKES ITS USUAL COURSE (NOT SEEN HERE)

He was discharged on February 3, 1927, with a diagnosis of chronic vesiculitis and was to return periodically for observation.

He was readmitted to the hospital May 29, 1927, complaining of a bearing down sensation in the rectum upon walking or sitting. Rectal examination showed no change in the original findings. A cystoscopic

FIG. 5. CYSTOGRAM IN CASE 2 FOUR MONTHS AFTER MUCH OF THE TUMOR TISSUE HAD BEEN REMOVED

examination showed a marked deflection of the course of the urethra to the right in its prostatic portion. There was no residual urine. The large mass pushed inward from the bladder floor and left wall. There

was a deformity of the vesical neck due to the bulging from the left. Both ureters were catheterized; the left ureteral orifice was displaced toward the midline of the bladder (see fig. 4). Drippings of urine from both sides were clear. The phthalein function was good. An X-ray picture revealed the two catheters on the right side of pelvis; the right one extended to the kidney, while the left one extended to the level of the lower sacro-iliac synchondroses on the right side of the pelvis, the tip of which is seen directed toward the left. Both urines contained

FIG. 6. THOUGH REVERSED IS A CYSTOGRAM EIGHT MONTHS AFTER OPERATION. RECURRENCE IS APPARENT

a few pus cells and gram-negative bacilli. A cystogram demonstrated beautifully the encroachment on the bladder cavity by the tumor mass (see fig. 5).

Rectally, at this time, a tremendous mass was felt on the left side, involving the region of the left seminal vesicle and extending upward farther than the finger could reach and medially well over toward the right side. The consistency was that of stiff dough. The rectal mucosa did not feel involved.

On June 8, 1927, a vasotomy was done and lipiodal injected into the

left seminal vesicle; X-rays taken at this time revealed a shadow in the region of the right seminal vesicle. It was concluded that the pelvic mass had displaced the left seminal vesicle.

On June 15, 1927, this patient was operated under ether anesthesia and the tumor mass exposed retro-peritoneally. The bladder was opened and found to be normal internally. This external mass almost completely filled the pelvis and extended up on the right to the right

FIG. 7. PHOTOMICROGRAPH (× 150) SHOWING MYXOMATOUS TISSUE REMOVED IN CASE 2. NOTE TYPICAL SPINDLE AND STAR SHAPED CELLS

iliac vessels. It was freed by blunt dissection and was partly encapsulated; one large mass about the size of a fresh spleen was removed. Further exploration revealed small fragments of tumor invading the whole pelvis, all of which could not be removed. It was concluded that the origin of the mass was from the region of the normal location of the left seminal vesicle.

This tumor was grayish in color, soft and doughy in consistence and gelatin like in appearance with large branching blood vessels being a prominent feature of its external appearance. It gave the appearance of a malignant tumor, arising from the region of the left seminal vesicle.

Pathologically the specimen consisted of a globular mass 8 by 6 by 2 cm. and many smaller relatively firm gelatinous bodies totaling a weight of 3008 grams. The surface of this globular mass was gelatinous with some relatively firm nodules throughout. The color was yellow brown and many blood vessels were seen to run through the tumor. The smaller masses were similar in character.

Microscopic sections revealed an edematous fibrous like tissue structure, the interstices of which, in places, contained a fine mucinous like material. The cells were markedly compressed and distorted. There were no definite findings from which a diagnosis of malignancy could be made. A pathological diagnosis of myxoma was made (see fig. 7).

The patient had an uneventful postoperative course. A rectal examination on July 12, 1927 revealed evidence of the tumor mass in the region of the left pelvic wall. He was given one deep X-ray treatment on this area. The suprapubic fistula closed in six weeks and the patient was discharged to return for periodic observation.

He was seen eight months later and was again complaining of pressure and urinary symptoms. Rectal examination revealed a return of the tumor to a great extent. Another cystogram also shows encroachment on the bladder cavity. However the patient has worked every day since his discharge from the hospital in July, 1927.

Ewing states that a myxoma is a tumor of mucous tissue. A primary myxoma is rare. When mucous tissue is present in a neoplasm three possibilities as to its significance must be considered. The mucous tissue may be developed directly from embryonal mucous tissue and the tumor be a primary myxoma. Or the tissue may represent a metaplastic product of other tissues and the tumor is a secondary myxoma. Or the tissue may result from chronic edema of other structures and represent a form of spurious mucous tissue. Myxomas are soft, lobulated, polypoid or papillary tumors, which on section are smooth, translucent and gelatinous. The encapsulation of myxomas is seldom complete, the mucinous material tending to infiltrate surrounding tissues. On this account complete extirpation is sometimes difficult and recurrence follows from persistence of widely disseminated mucous material cells. The structure of myxoma presents typical features of spindle- and star-shaped cells with processes anastomosing or disappearing in the matrix, and cyto-

plasm usually containing fatty and watery droplets. The clinical course of myxoma is of a slowly growing tumor which produces no symptoms except local swelling and pressure. In the testis, spermatic cord, and possibly in the kidney myxomas are probably of teratoid origin.

Because of their extreme rareness as a primary tumor and the fact that our lipiodal solution demonstrated the left vesical pushed to the opposite side, a tumor of the seminal vesicle or perivesicle tissues in the above case is not likely, but not necessarily out of consideration.

Procrastination, no doubt, defeated any possibility of relief in our first case and possibly prevented a more thorough or even complete removal of tumor tissue in our second case. An early exploration would seem justifiable in all such instances.

Both of these cases caused us much trouble in diagnosis. We do not justify our routine of procedures but hope this report may be helpful in similar cases.

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SPINA BIFIDA OCCULTA

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In spina bifida, or meningocele, the bladder is affected only if the defect includes the nerves supplying it. The seat of the lesion is often low enough to avoid the upper roots of the sacral plexus, but includes enough of the nerves supplying the bladder so that there will be incontinence without paraplegia.

Spina bifida occulta may cause the same symptoms as a true meningocele and the case to be reported here bears this out.

At times the symptoms referable to the bladder do not occur until the child is two or three years or even older. This is explained by the fact that as the child grows older increased pressure on the nerves may occur, thereby causing symptoms referable to the urinary tract. This also occurred in the case to be reported here.

The case we wish to present at this time is one of spina bifida occulta.

The symptoms these patients present are very similar to those caused by valve formation, with the exception that this class usually have some innervation involvement of the rectum and sphincter, causing constipation, loss of control and even marked dilatation of the sphincters.

In many a mistaken diagnosis of pelvic tumor has been made, due to a tense tumor mass being felt suprapubically and on rectal examination. Complete retention is usually absent, but there is a large amount of residual urine with overflow.

The ability to hold the urine varies at different times. Many patients present no other innervation involvement other than the bladder and rectum; reflexes and muscular tone in the extremities not being involved.

Diagnosis is made by physical examination, presence of a low abdominal tumor, often very tense, felt in the rectum and giving

the feel of a solid tumor. If infection is present the patient of course gives a history of chills, fever and pyuria. Cystoscopic examination is the sure way of making an accurate diagnosis as the bladder picture is typical of the so-called spinal bladder, with fine trabeculations, and dilatation of the posterior urethra.

However we would strongly urge that no cystoscopic examination be made if the patients urine is uninfected, as these patients will probably live much longer if allowed to overflow, as in traumatic spinal lesions, which we all recognize as doing better without instrumentation, due to the great danger of infection. Our own case had infected urine when we first saw him, therefore we did not hesitate to make a complete examination.

In spinal bladder operative intervention on the bladder is futile except bladder drainage. There have been one or two of these patients who have had implantation of the ureter in the rectum but the results have not been satisfactory.

I am indebted to Dr. Crawford for abstract of notes on this patient.

Patient first seen by Dr. Crawford in 1919, when he was one and a half years old, for constipation. A normal, well nourished, developed baby. No abnormalities or deformities noted other than a slight asymmetry of the sacrum. Nothing to excite suspicion of later development.

When two years old (1919), seen for croup. No incontinence of urine, not constipated. No paralysis and no abdominal pain up to this time. Not seen again by Dr. Crawford until November, 1923.

In 1920 patient had whooping cough, preceding this, constipated, bed wetting and wetting during the day. These symptoms made worse by whooping cough.

March, 1921, tonsillectomy and circumcision. Continued dribbling of urine and incontinence of feces after operation. Child specialist in Brooklyn decided it a matter of training and put the child in charge of a nurse for this purpose. May 1921 no success.

In September, 1921, patient had abdominal pain, fleeting in character. Seen by Elsberg and McLean of New York, spina bifida diagnosed provisionally. Slight dragging of one leg. Operation advised against. Strychnine for six weeks. Later severe abdominal pain, no fever. Strychnine stopped.

In 1922 under Smith and Ladd's care in Boston for about a year.

Abdominal tumor discovered, considered possibly displaced kidney or some congenital deformity associated with the bladder. Barium enemata and fluoroscopic examination showed mass not connected with the colon. X-ray showed normal spine down to the third vertebra in the sacrum. There was a marked dislocation of the coccyx to the right, leaving, of course, a definite absence of the bony structure on the left. Needle inserted in apparent sac; no spinal fluid obtained. This indicated to them that the swelling was not a sac of the spina bifida but rather a fat pad. The question was whether or not there was some condition associated with the diaplacement of the coccyx exerting pressure on the nerves which resulted in the incontinence of urine and feces; or whether the symptoms were due to the nerves being involved in the sac of the spina bifida. Operation, of course, contraindicated in latter case, but might help in the former. Operation, exploratory, considered if pain and other symptoms persist.

November, 1922, Walter Reed Hospital under care of Major Shields. Constipated, followed by a series of acute abdominal attacks (more on right side, kidney region), till January, 1923. Bladder catheterized, not more than one ounce of cloudy urine (pus) injected in guinea-pig. No tuberculosis.

January, 1923, Key West. No pains or fever. Marked improvement in condition. Able to hold urine a little, with passage of short stream in place of constant dribbling.

First seen by me on November 20, 1923. Patient five and a half years old at this time. Examination showed some tenderness over both kidneys, which felt as if they were enlarged. In the suprapubic region, just to the right of the middle line, there was a large globular mass, almost as large as a man's fist, movable, and on rectal examination it could be grasped between the fingers and hand. We felt sure that this was a distended bladder, and on catheterization the mass disappeared. As soon as the catheter passed the external sphincter the urine appeared, showing a relaxed internal sphincter. Eleven ounces of very cloudy urine was obtained. Bladder irrigated and patient cystoscoped. Mucosa showed chronic inflammation. No diverticula were seen. Fine trabeculations were scattered over the entire wall as is seen in tabes. The posterior urethra was widely dilated. The cystoscope was drawn down so that the verupmontamun could be easily inspected. The fluid in the bladder resting on the cut off muscle. Although the patient had just had an enema the rectum was distended with fecal matter.

There was, unquestionably, some innervation involvement of the

rectum as well as the bladder. The sacrum was deflected to the side leaving depression on the opposite side.

Both ureters were catheterized and very purulent urine was obtained from each. On filling the bladder with argyrol it regurgitated along the catheters to the kidney pelvis and drained out of the catheters, showing bilateral damage of the ureters as well as the kidneys. A diagnosis of spina bifida or some nerve lesion due to deformity of the sacrum was made, and after consultation with Dr. Kerr we felt that nothing could be promised from any surgical procedure.

In March, 1924, the patient had an acute attack with high temperature; both kidneys were palpable and acutely tender. The child was gravely ill. The ureters were catheterized and pelvic lavage with a weak solution of silver nitrate was given. The pain rapidly subsided, the urine became clearer and the temperature gradually returned to normal. The bladder was irrigated every other day and after ten days the patient appeared to be in his usual condition. On distending the bladder the fluid would regurgitate to the kidneys and wash out the pelvis.

Period from above attack to last attack beginning about the middle of October, 1925.

Child in good general condition. No attacks. Urine always more or less cloudy. Periodic bladder irrigations always at first intimation of abdominal pain or temperature elevation. Increasing control of urination amazing, passing 8 to 10 ounces at a time. Napkin removed for several hours at a time with no dribbling. Daily laxative for constipation. Child running about like any normal boy of his age, climbing trees, etc. Mentally exceptionally precocious. Just before last illness had not been catheterized for two months. Had gained seven pounds and looked splendidly.

Last illness different from previous attacks in that it began as an acute gastro-intestinal upset, with vomiting and diarrhea. Temperature from 99° to 103°. No real pain although general abdominal uneasiness, not localized. Kidneys not enlarged. Urine ladened with pus. Vomiting increasing in severity. Unable to retain nourishment. Rectal feedings for four or five days. Unable to retain water. Very toxic. Died October 27, 1925, at Walter Reed Hospital.

Copy of autopsy report from Walter Reed Hospital

External appearances: The body is that of a male white child about eight years old, height about 49 inches, weight about 40 pounds. Nutrition and musculature poor. Fairly well marked post mortem hyposta-

sis over back. Many small atrophic scars over forearms and legs. Grandular system negative. Eyes sunken, pupils are moderately dilated; equal; slight defect on sclera of left eye.

Abdomen: Contains no free fluid. No abnormalities of gastro intestinal tract. Pelvic lymph glands considerably enlarged. Both ureters are considerably enlarged and very tortuous. Kidneys, ureters, bladder and posterior urethra removed en masse and preserved as gross specimen.

Right kidney: 9½ by 2 by 5 by 2½. Very irregular nodular surface showing whitish spots on a reddish brown kidney. Pelvis enormously dilated at the expense of the cortex, which is reduced to a thinness of about 6 mgm. Pelvis is filled with a thick creamy fluid. Mucosa considerably thickened. Cut surface of the kidney shows a much thinned cortex; dilatation of calices; grayish white parenchyma. Left kidney same as right.

Ureters: Enormously enlarged and very tortuous. Diameter varying from 1 cm. in upper half to 6 cm. in lower half.

Bladder: Thickened, injected. Urethral orifice and posterior part of posterior urethra are much dilated to a cone shaped prolongation of bladder lumen.

Spine: The spinal processes and transverse processes of the cervical, thoracic, lumbar vertebrae are normal in shape and position; the sacrum and coccys are deformed, the main mass of the sacrum being about 2 cm. to the right of the middle line, lacking in normal conformation and to external appearances showing a concave defect in its center about 3 cm in diameter, which is moderately soft to palpation and shows no tendency to bulge or fluctuate. On removal of skin and subcutaneous tissue it is noted that this soft area is due to a defect in closing of the sacrum, leaving an area of about 2 cm. in diameter, through which can be felt a pad of soft fatty tissue, containing remnants of meninges, cord and nerves. The coccyx at lower line of sacrum is small and curved upward and to the left. On opening the spinal canal, lumbar and sacral, it is found that the lumbar cord extends downward into the sacral canal to become fused with sacral mass at the level of the lower lumbar vertebra. The sacral mass which lies beneath the defect in sacrum and fills the enlarged sacral canal is 4 cm. vertical; 2 cm. lateral; and 1 cm. in thickness; composed of a large mass of fat, strands of spinal core remains and meninges, and at the upper edge, is itself, intimately attached to the spinal cord by radiation of fibers of latter into this mass.

SUPRAPUBIC CYSTOTOMY IN BLADDER PARALYSIS

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There exists a difference of opinion among urologists as to the best method of handling the retention of urine which occurs in patients with acute paralysis of the bladder. Some advocate attempting to empty the bladder by massage of the prostate and pressure on the abdomen with no catheterization under any circumstances. Plaggemeyer in supporting this method says that aspiration suprapubically with a needle may be permitted in extreme cases and is preferable to cystotomy or catheterization. Some advocate intermittent catheterization; a few indwelling catheters; and a few suprapubic drainage. The object of this paper is to attempt to show that suprapubic cystotomy is the method of choice in nearly all of these cases.

If the problem was simply that of relieving a retention of urine there would be no reason for an extended discussion. But, as Thompson Walker points out, the most important clinical factor in his study of cases of gun shot wounds of the spine are the infections which occur in the urinary tract. That is the case also with other severe acute injuries of the spinal cord where the life of the patient is usually most seriously endangered by infections which so readily develop in the kidneys and bladder. The urological problem then in these cases is to prevent urinary infections, or, if that cannot be done, to prevent as far as possible the serious effects which arise as the result of the infections.

Thompson Walker (1), Head and Riddoch (2), and Plaggemeyer (3) have made detailed studies of these cases and in their published articles are to be found many interesting things which it is not possible nor necessary for us to mentioned here. Their investigations and observations were, it is true, made almost entirely upon cases of gun shot wounds of the spine. The

[1]By invitation.

paralysis which develops in such cases however, and the subsequent course of events relating to the urinary tract, are not different from other severe injuries to the spinal cord which are seen in civil practice, because a similar sequence of events occurs both in fractures of the spine from trauma and in certain cases of acture poliomyelitis and in acute infections in and about the spinal cord. It is worth while remarking also that often the paralysis of the bladder is, in the beginning, just as severe and as serious in patients where the cord has not been completely destroyed, where some, often a good deal, of sensory and motor function subsequently return to the bladder and other motor organs, as in those with complete transverse lesions of the cord. In the first few weeks the urological condition is apt to be the same as though the cord had been completely destroyed.

Concerning the location of the lesion in the spinal cord we learn from the work of Thompson Walker, Head and Riddoch, Kidd (4) and Plaggemeyer that any severe lesion of the cord from the cervical region to the cauda equina results in a paralysis of the bladder, and in favorable cases to the development later on of automatic micturition. About lesions of the cauda equina Thompson Walker says, "Periodic reflex micturition (automatic micturition) develops in more than half the cases of cauda equina lesions, but occasionally voluntary micturition follows directly on a period of complete retention." So much for the location of the lesion.

What happens in the urinary tract in these cases of spinal cord injury is this: There is immediately a complete paralysis of the detrusor muscles of the bladder with an active (tonic) contraction of the internal (vesical) sphincter. Urine accummulates in the bladder, there is an enormous distention of the bladder, and usually in forty-eight hours there is an overflow incontinence of urine. If conditions are favorable this gives way in four or five weeks to automatic micturition. Before that appears the bladder will gradually begin to discharge at irregular intervals more and more of the contents and as the result of this the bladder capacity is probably slowly reduced. Then rather suddenly, when the so called automatic micturition develops, a large quantity of urine

is expelled at each micturition. But the authors whom I have mentioned all report that the bladder is not usually emptied even when the most satisfactory automatic micturition is established; varying quantities of residual urine, at times large amounts, are found in nearly all the cases which have been studied.

It has been shown by Head and Riddoch that the contractions of the bladder wall begin before automatic micturition becomes established and they call attention to the obstruction which the internal sphincter offers to the development of automatic micturition. Further they believed that the development of automatic micturition was due to a return of the ability of the internal sphincter to relax in coördination with the contraction of the detrusor muscles. They were not able to prove this coördination and in the light of Plaggemeyer's findings, that in the later stages the internal sphincters of all these patients are relaxed and the vesical orifice stands open, we are inclined to believe that the gradually increasing vigour of the contractions of the bladder walls eventually overcomes the waning contraction of the internal sphincter. From studying Fearnsides' (5) article on the innervation of the bladder and Ranson's (6), anatomy of the central nervous system it would seem that coördination of the internal sphincter in these automatic bladders should occur; and it may; but it is questionable as to whether or not it is of much significance.

That automatic micturition has been shown to develop in many of these cases within a few days or weeks after the appearance of paralysis would seem to offer some authors an argument against bladder drainage by so radical a procedure as cystotomy. Among those whose works on bladder paralysis we have found worth careful study Young (7) and Plaggemeyer are the only ones who advise against catheterization. Young, because the work of a few men during the War, showed that the attempt to treat the cases without catheterization was well worth trying, but in his recent book on Urology (8) he states very clearly that he has not been able to find enough evidence of successful treatment without catheterization to substantiate the contention that the method is of value. Plaggemeyer has made interesting and valuable observations on a group of these cases but only upon

those where the condition had existed for a long time. He had had little if any experience with the cases during the acute retention immediately following the injury. His conclusions therefore concerning the treatment indicated for them are interesting, but not convincing. One of the interesting things that he found was that in two cases where the kidneys were examined at autopsy no hydronephrosis existed. That is very likely the condition which would be found in most of the cases in which the paralysis had existed for a long period of time, but one could certainly expect to find an acute hydronephrosis in the early stages if the bladder were permitted to remain continually overdistended. But unless the dilatation of the pelvis and calyces was continued for a long time, or accompanied by an active pyelonephritis the dilatation would tend to gradually disappear as the back pressure from the bladder was satisfactorily relieved by catheterization or automatic micturition.

Urinary infection in these patients occurs in the same way in which all urinary infections occur. In their development two facts have to be considered, first those changes in the urinary tract which permit the growth of the bacteria, and secondly the appearance of bacteria in the urinary tract brought by the blood stream from some focus of infection or lesion elsewhere in the body. It has been demonstrated repeatedly that an active infection of the urinary tract does not occur when organisms are injected or carried into the normal kidneys or bladder, but infection does develop when the bladder or kidneys are already injured, as for example by obstruction to the outflow of urine or by the toxins eliminated in acute infections or acute infectious diseases. It is so common an observation that colon bacilli are often found in the urine even after what may seem a slight disturbance in the gastrointestinal tract that it is hardly necessary for us to take your time to elaborate upon that point. That there is sufficient change in the paralyzed bladders of all these cases to readily permit the development of infections needs no proof. That the kidneys in many cases are made susceptible to the development of infections must also be generally admitted. And in these cases, where a paralysis of the intestines occurs, the intestinal disturbances are

often so marked that there is ample reason to believe that in many cases colon bacilli are passed into the blood stream and thence to the kidneys. This in our minds is the method by which many of the patients acquire kidney infections, and through the same source bladder infections would occur more frequently than kidney infections; first, because the bladder is paralyzed in nearly all severe injuries to the cord while the kidneys if they are ever sufficiently disturbed by the paralysis are not involved in the lower cord lesions; secondly, because the effects upon the urinary tract of retention of urine due to obstruction at the vesical orifice appear first and most frequently in the bladder.

Though the kidneys may not be made susceptible to infection by an injury to their nerves they are often damaged by overdistention of the bladder for when the bladder becomes overdistended with urine the intravesical pressure becomes very great. Although in many instances the muscles of the abdominal walls are paralyzed the intra-abdominal pressure is very marked as the result of the accumulation of gas in the intestines and large amounts of urine in the bladder and there must be a consequent increased pressure of urine in the ureters and renal pelves both from back pressure of the urine and from increased intra-abdominal pressure. Hydronephrosis at this stage certainly must exist if overdistention of the bladder is permitted to occur. And if the colon bacilli are passed to the kidneys from the intestines, the patient is in more danger of a kidney infection at this stage as the result of not employing a catheter than he would be if a catheter were used, not only because of the actual changes in the kidneys due to back pressure but also on account of the added gastro-intestinal disturbances which that back pressure causes.

Thompson Walker calls attention to the fact that, once the bladder has become infected, its overdistention with urine or irrigating fluid in all probability readily causes a regurgitation of fluid up the ureters thus carrying the organisms from the bladder to the kidneys, and he warns against putting any except small quantities of irrigating fluids in the bladder at one time. Though the kidney infection may originate in this way it is certainly not the only method of infection. We have not been fortunate

enough to see more than one case with paralysis of the bladder before catheterization and to prove that the conclusions which we have reached concerning the intestinal origin of infection we realize that it will be necessary to obtain urine for culture from some of these cases by suprapubic puncture. But in the light of our knowledge concerning the origin of urinary infections our conclusions seem reasonable, and we have one patient illustrating infection without catheterization.

TREATMENT

If we are correct in our assumption that infection is most likely to occur in these cases regardless of catheterization, then there can be no question but that in their treatment we must follow the best accepted surgical principle, namely, that the best treatment of infection is by drainage.

The tied-in catheter was advocated by Kidd for handling the soldiers suffering with spinal injury received at the Front. While that may be a suitable method under the conditions for which he advocates it there is ample argument against its use in civil practice. All of the tissues in the paralyzed areas are in a state of lowered resistance to pressure and infection; bed sores for example develop readily and become extensively infected and are hard to heal. The urethra must share in this lowered resistance, and the infection developing in the prostatic urethra about the catheter would be closed in by the tonically contracted vesicle sphincter and readily extend to the paralyzed prostate and seminal vesicles.

Intermittent catheterization is not satisfactory for several reasons. (*a*) Traumatism of the urethra causing prostatis, seminal vesiculitis, and epididymitis. (*b*) Failure to keep the bladder sufficiently empty for the most efficient results unless frequently passed. (*c*) The need of employing a urinal between catheterizations to catch the irregular discharge of urine which may wet the patient and the bed and predispose to the development of bed sores. (*d*) Comparatively unsatisfactory for bladder irrigations. (*e*) The not infrequent need for continuing its use for a long time, even for months. For Thompson Walker, Head and Riddoch, and Plaggemeyer show that automatic micturition

frequently is accompanied by a large residual urine. And Head and Riddoch are very clear in their conclusions, that with severe complications such as cystitis, pyelitis, infected bed sores, etc., the patients may be months in developing automatic micturition or it may never occur. Also that when these complications arise, after automatic micturition has satisfactorily developed, that it may be greatly interfered with, and the bladder retain a large amount of urine unless it is much contracted.

Our experience in treating cases having chronic infections of the bladder, with and without renal insufficiency, which are due to obstruction to urination caused by changes at the vesical orifice such as bars and prostatic enlargement has satisfied us that suprapubic cystotomy is superior to intermittent catheterization. We have had such patients very sick, with benign prostatic hypertrophy and its consequent bladder and kidney changes, grow steadily worse on intermittent catheterization, who began their recovery as soon as suprapubic cystotomy was performed.

Continuous drainage offered by suprapubic cystotomy is the logical method of treating these patients with paralyzed bladders. Catheterization with all its observances is avoided; the bed is not wet by unexpected voiding or overturning the urinal which is so often kept between the patient's legs; frequent irrigations of the bladder through the suprapubic tube are easily performed by the nurse or the patient's family; continuous irrigations of the bladder are possible as suggested by Thompson Walker, and the patient lives longer and remains at least comparatively free from recurrent acute kidney and bladder infection.

Plaggemeyer showed a nitrogen blood retention in his cases which in many of them improved very much during the two or three months that he had them under observation. Our two cases with permanent suprapubic drainage have fairly normal blood constituents, urea nitrogen 10.8 and 15, and non protein nitrogen of 17.4 and 32.7 per 100 cc. of blood.

There can be no question in our minds, but that suprapubic drainage would have saved the lives of many a soldier had it been properly performed shortly after the spinal injury, and in civil life we shall be able to save many lives that we would otherwise

lose. And if there is later sufficient recovery to warrant a removal of the tube, that recovery will have been greatly facilitated by the prevention of the ill effects of urinary retention which the tube affords, and the walls of the bladder will not be so greatly changed by inflammation as they usually are without suprapubic drainage.

We have 8 cases which I wish to discuss.

The first case we did not operate upon. He had an acute myelitis coming on after an acute febrile attack which occurred four years before we saw him. When he came to us he had a partial paralysis from the hips down, and was unable to walk. He had not had sufficient paralysis of the bladder at any time, even at first, to cause annoying symptoms, except once about six months before we saw him when he had painful and frequent urination with some hematuria. The interesting point about this case is that he came into the hospital for some operative orthopedic work upon his feet, and his urine was *uninfected*. While in the hospital he had a general anesthesia three times and after the second one developed an acute infection of his bladder and probably of the right kidney *without* being catheterized. It was at that time that we were called to see him. After that attack the urine remained infected and six months later he had a residual urine of 250 cc.

We report this case because it illustrates what I have mentioned; the occurrence of infection of the urinary tract without catheterization. It is probable that he had had a residual urine since his initial spinal cord lesion, and we have evidence that he had a residual after the infection occurred.

The second is a case of poliomyelitis with acute paralysis of the bladder. He was treated by catheterization for several weeks. Then in hopes that he would develop automatic micturition catheterization was stopped. In a week he was having chills and fever and was very sick. We saw him and reinstated catheterization. A severe cystitis persisted for several weeks and during that time we catheterized both ureters and to our surprise found the kidneys uninfected. We did not think that so much fever could come from a cystitis alone. The poliomyelitis had largely subsided and he was beginning to develop automatic micturition.

We advised suprapubic cystotomy and it was refused and contrary to our advice catheterization was stopped about three months after the paralysis began.

He died about a year later with symptoms which were evidently produced by urinary infections. During the year he had occasional attacks of chills and fever. The bladder became smaller but it was rarely if ever emptied by automatic micturition; he had 75 cc. of residual urine a month or two before he died and 100 cc. or more at a previous examination. Had suprapubic cystotomy been performed we are confident that he would be now alive for the only annoying paralysis which persisted other than of the bladder was a paralysis of his legs, and that not complete. His general health for a while was good but was eventually impaired by the chronic urinary infection and its exacerbations.

The third case is a boy aged seven in whom an acute metastatic abscess about the spinal cord, at the first thoracic vertebra, developed following carbuncles. A laminectomy was performed by Dr. C. E. Dowman and a collection of pus outside the meninges was drained. The acute paralysis of the bladder was treated first by catheterization, but a severe cystitis developed and a suprapubic cystotomy was performed. The septic type of temperature which had been present then largely disappeared. But symptoms of other metastic infections continued and he died about six months later. The suprapubic tube worked satisfactorily until he died and was cared for by his nurse, the family, and the local physician, and he remained free from further disturbances in the urinary tract.

The fourth case was that of a traumatic fracture of the spine at the twelfth thoracic vertebra with practically complete destruction of the cord. Shortly following the laminectomy, done almost three months after the injury, the cystitis became so severe that a suprapubic cystotomy was permitted. We were unable to keep in touch with the patient after the cystotomy for he was carried back to his home in a different city, but his wife wrote that the tube worked satisfactorily until his death about six months later. It is probable that he died as the result of the urinary infection which no doubt became very extensive during

the three months following the injury when he was treated by catheterization.

The fifth and sixth were cases of paralysis of the bladder following traumatic fracture of the spine. They eventually had a sufficient return of spinal cord function to permit imperfect walking and the removal of the suprapubic tube. I lost tract of one of the cases whose tube worked satisfactorily for several months, until be began voiding more or less normally and walking with a stick. But reports from the other show that four months after the removal of the tube he voids frequently, but holds his urine fairly well, and also walks with a stick.

Both of these cases were treated by catheterization before I saw them; both had severe cystitis, and one an epididymitis, and I consider that in both cases the bladders were saved from serious damage and the recovery of the patient greatly facilitated by the treatments of the bladder through the suprapubic tube and by the suprapubic drainage.

The two remaining cases are paralyzed for life by traumatic injuries of the spine, the result of automobile accidents. One a girl of seventeen and the other a man of twenty-nine. Both were catheterized for a few days before I saw them. Both developed a severe bladder infection. The man has worn his tube for a year, the girl for nine months. The man for eight or nine months has been perfectly well except for the paralysis from his legs down, his temperature has remained normal, and the blood constituents only a little increased. There is of course a slight bladder infection but it is well cared for by the suprapubic drainage which works perfectly. The deformity of the misplaced first lumbar vertebra in the girl has been annoying and for two or three months she had several attacks of cystitis and on two occasions very probably attacks of pyelitis, but for some months now she has been bright and seemingly in good shape. She had 50 per cent phthalein output in twenty-five minutes after an intravenous injection.

We do not believe that the girl would have recovered without suprapubic drainage, and think that they both owe their present good health to the suprapubic drainage and the bladder treatment through the suprapubic tubes.

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EXPERIENCES WITH SUBMUCOUS FIBROSIS OF THE BLADDER

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It is unnecessary to describe to this Association the symptomatology and pathology of submucous fibrosis. Most of the articles on this subject in the American journals were written by its members. This condition was described by Skene (1) in 1887 under the name of "interstitial cystitis;" by Nitze as "cystitis parenchymatosa;" by Hunner (2) in 1914 as "elusive ulcer" of the bladder. A. R. Stevens (3) has called it "pan-mural cystitis," but it would seem that the name "submucous fibrosis" best describes the outstanding feature of the condition, and has the widest application. W. A. Frontz (4), in an article entitled "Clinical and Pathological Study of Contracted Bladder," refers to the fibrosis of the submucosa as the striking characteristic; in 14 of his 26 cases, the entire bladder wall was involved, but in 8, the wall was not thickened and the process was largely limited to the submucosa.

The interesting points in connection with this lesion are (1) the etiology (2) the success with which it escapes detection (3) its association with urethral lesions and (4) the results of treatment. I should like to discuss each of these points in turn, basing what I have to say both on the conclusions of others and on a series of 6 cases occurring in my own practice.

These 6 cases included 5 women and 1 man. The ages of the former were: 33, 46, 47, 50, 57; the man was 41. The symptoms were characteristic—frequency of urination and intense pain when the bladder was filled to a certain capacity. The limit of distension was 3 ounces in 3 cases, and 4 ounces, 5 ounces and 6 ounces respectively in the other 3. In addition to the symptoms caused by distension, 4 of the women experienced severe pain referred to

the urethra. In 1 it was present constantly as a dull ache, punctuated by sharp stabbing pain; another felt as if she were "sitting on a coal of fire." Two women complained of pain which they located deep in the pelvis. In one of these cases, bimanual pressure on the patient's left elicited the pain and a thickening could be felt in the left side of the pelvis. At operation, this thickened area proved to be in the bladder wall. The pelvic organs were normal.

Tuberculosis was excluded in all of these cases, and renal infection was ruled out by catheterization of the ureters if the urine showed abnormalities.

Two theories have been advanced as to the etiology of this condition. One is that the fibrosis is the after-effect of a preceding acute cystitis. Against this theory is the fact that acute cystitis is very common, whereas submucous fibrosis is quite uncommon. We should expect more instances of this lesion following cystitis, if the latter were its cause. In this series of 6 cases, not one gave a history of acute cystitis. All said that their symptoms came on gradually, or were intermittent at first, later constant.

The other theory is that the lesion is due to bacterial invasion of the bladder wall by means of the blood stream, the organism gaining entrance from a distant focus, such as teeth or tonsils. Hunner (5) has insisted upon the importance of removing possible foci. Kretschmer (6), in a study of 44 cases, found chronic infection of the tonsils in 12, abscessed teeth in 8, chronic maxillary sinusitis in 2, chronic cholecystitis, chronic otitis media, chronic rhinitis and leucorrhea in 1 each. He does not consider the causal relationship as proved by any means, but he believes that possible foci of infection should be removed. Bumpus and Meisser (7) in 1921 published the results of experimental work which seemed to show a selective affinity on the part of certain strains of streptococci for the organs of the urinary tract. Nineteen animals were injected intravenously with primary cultures from the teeth or tonsils of patients with submucous fibrosis. Of these animals, 16 showed lesions in the urinary tract; in 13 of them the lesions were located in the bladder. In an endeavor to learn

more about the etiology, Kretschmer sent the resected portions of bladder wall from 3 cases to Dr. Geo. F. Dick, who macerated and cultured the tissues without conclusive results. Bacillus Coli was found in 1 case, a streptococcus in another, and in a third a few colonies of staphylococcus albus and many colonies of diphtheroid bacilli. It would seem reasonable to believe that the original infecting organism would have died out in many cases, particularly in those of long duration, consequently a negative culture would be no proof that a specific bacterium had not once been active. Hunner has referred to stricture of the ureter as a causative factor in submucous fibrosis. He does not explain the relationship between the two processes, and it would seem probable that if there is any relationship, it would be that both lesions were the results of the same cause, rather than that the bladder lesion was due to the ureteral lesion.

In the six cases which I have studied, the following evidence as to foci was obtained: 2 cases had had abscessed teeth removed; 3 cases showed no evidence of infection in teeth or tonsils; 1 case had very large tonsils, but no history of infection in them. Her laryngologist's report has not yet been received.

The term "elusive ulcer" was employed by Cullen and Hunner to designate these lesions because of their changing characteristics. From the standpoint of its detection, the condition does indeed appear to be elusive, if one may judge from the long histories of these patients and from the number of physicians, urologists as well as others, who have attempted in vain to relieve their symptoms. In these 6 cases, the symptoms had existed for 10 months in one case, 1 year in another, and in the others for 3 years, 4 years, 5 years and 7 years respectively. Some of the patients had been thoroughly studied by excellent urologists, but either the condition was not in evidence at that time or had been overlooked. Apparently it is difficult to believe that so inconspicuous a lesion can produce so much discomfort.

Another feature of this condition which has interested me has been its association with a chronic urethritis. Hunner (8), in 1918, spoke of the "infiltration, granulation and extreme hypersensitiveness of the urethra" which was present in all of his cases.

In the 6 cases in my series, one, the woman with only 10 months' duration of symptoms, apparently had no urethritis, as her symptoms were entirely relieved by one diathermy treatment. In another case I did not do a urethroscopy, but did dilate the urethra at every treatment, apparently with relief. One woman showed a "beefy red urethra which bleeds easily;" another, a "very red" urethra; a third, "a red and shiny" urethra. The man had a very definite granuloma of the posterior urethra which was treated before I attempted to treat the submucous fibrosis.

The significance of the urethral condition is not entirely clear to me. Urethritis of this type occurs quite frequently as the aftermath of a urinary infection, and I suppose there is enough infection in these ulcer cases to produce a urethritis. Cultures from the urine of these patients showed a growth from 4 and no growth in 2. There seems usually to be a very mild infection which flares up when sloughs are formed by electrocoagulation of the ulcers. Kretschmer found sterile urine in 19 out of 36 cases. The colon bacillus was present in 9, the staphylococcus in 8. Hunner attributes the urethritis to absorption from a distant focus; as early as 1910 he read a paper entitled "Chronic Urethritis and Chronic Ureteritis caused by Tonsillitis." Whatever the cause of the urethral condition, there is no question but that it must be treated as well as the bladder lesion, for a good part of the patient's symptoms appear to be due to it.

The best way to treat submucous fibrosis is still an open question. The view once held by many that resection of the affected area of the bladder wall is the only logical procedure has been distinctly modified. Kretschmer (6) reports that of 11 cases so treated, 50 per cent were cured, 40 per cent recurred and 10 per cent were improved. Frontz (4) reports 15 cases operated upon, either by resection or by cystotomy and deep cauterization. Of these, 2 died; 13 were relieved of pain, 7 were relieved of frequency, 6 continued to have frequency but no pain. Hunt (9) reports the result of 20 cases treated by resection. The immediate result in all was excellent, but of 17 known late results, there were but 5 cured and 5 improved. Three were not improved and 4 had complete recurrence. Furniss (10) reports 3 excisions, in all of which the lesion recurred.

The first case in my series was a woman of 33 with a very definite, typical submucous fibrosis in the left base, close to the ureteric ridge and just posterior to the interureteric level. After 11 months of urethral dilatation and bladder distention, which relieved her at first but later proved ineffective, I excised a portion of the bladder wall 2.5 by 1.5 cm. This section showed a dense white stratum of fibrous tissue about 2 mm. thick directly beneath the mucosa. The pathological report stated it to be composed of "inflamed tissue and edema." On the mesial side of the excised portion this stratum was absent, but on the outer edge it was clearly visible, showing that I had cut through it and had not excised the entire area. If I had done so, it would have necessitated transplanting the left ureter, for I had cut as close to that as I dared. The patient had a stormy convalescence, with phlebitis in both legs and probably in the pelvic veins. For six months she was entirely relieved, but then the symptoms recurred as severely as before. Cystoscopy showed, close to the scar of the excision, a dark red area covered with edematous mucosa. A report just received from the patient states that the symptoms are as bad as ever. It would have been less dangerous and more efficacious if I had treated this area by electrocoagulation through the open bladder.

Apparently the only effective alternative to excision is electrocoagulation. This can be done through the cystoscope if the lesion is not too extensive, and it is usually done in this way. Kretschmer followed this method in 24 cases, of which 6 were cured and 16 improved. I employed it in 5 cases. In 3 of these a brief gas oxygen anesthesia was used. The other 2 were treated in the office under cocain anesthesia. The treatment is painful, and I believe that one can do a more thorough job with the patient under full anesthesia, either general or caudal. The method I have used has been to burn by bipolar electrocoagulation multiple punctures in the reddish area which is thought to indicate an underlying fibrosis. The areas of gray necrosis so formed almost coalesce. There will be sloughing for 2 or 3 weeks, and occasionally some bleeding. After the edema incident to the trauma subsides, the mucosa which formerly was red and congested

assumes the color of normal bladder mucosa and usually has a puckered appearance. Later, after the slough clears up, the burn heals as a cicatricial ridge, but it and the surrounding mucosa no longer have an angry, red appearance. To the surgical eye accustomed to gauge the progress of infections, the tissues present a healthy appearance, free from inflammation. Recurrences appear as localized areas of red, with tabs of fibrin adherent, either close to the cicatrix, or in the other parts of the bladder.

I will review very briefly the results obtained by this method.

Case 1

R. K., male, age forty-one, October, 1923.

For seven years he had suffered from frequency and urgency. He seldom voided more than two ounces at a time and had to void from four to eight times at night. Examination showed a granuloma of the posterior urethra and in the dome of the bladder a ridge of cicatricical tissue 1.5 cm. long, surrounded by a reddish area with fibrin adherent. He was somewhat relieved by treatment of the urethra, but still had much frequency.

January 16, 1924. The area was fulgurated without much relief.

April 16, 1924. Eight holes were burned in this area.

June 28, 1924. He has some frequency but no irritability; occasionally holds urine four hours; capacity 6 ounces.

The area treated is scarred but not red.

October 11, 1924. Capacity 4 ounces; frequency every 2 to 3 hours by day, at night two to three times.

April 26, 1928. A letter just received from the patient states that save for some frequency once in a while, he is fine and has had no irritability of the bladder for months.

Relieved but not cured.

Case 2

E. S., female, age fifty, December, 1925.

Symptoms. Pain deep in pelvis, on left side. Sudden movements are painful. Frequency of urination, every 2 hours by day, at night three to four times. Duration 14 months. She had a suspensio uteri in March, 1925, which gave relief for several months. Examination showed a moderate degree of urethritis and trigonitis and two areas of submucus fibrosis were seen in the dome of the bladder. Electrocoagulation of

these areas on December 15, 1925, and January 13, 1926, with much relief. The pain disappeared and the frequency diminished. She went abroad for 16 months. Six months after leaving this country, she had a slight recurrence of bladder symptoms and then developed a severe colitis, after which the bladder became worse. She saw Professor Heitz-Boyer who found two small patches of "congestive cystitis" near the top of the bladder and outside of the right ureter. He also found a sub-acute inflammation of the urethra and concluded that "these lesions seemed to be of an inflammatory origin and related to an elimination, probably ancient, of colon bacilli, and due to an entero-renal syndrome." He advised radical destruction of the lesions with high frequency. After the patient returned to America, on October 24, 1927, under gas-oxygen, cystoscopy showed two healed areas in the roof but in the right base just inside the ureteric ridge was a deep red area, 1 cm. in diameter, which bled freely on distention of the bladder. The ureteral specimens showed no pus and no growth. The area in the base was electrocoagulated in four or five places and the bladder dilated to 14 ounces. On December 7 this area seemed much the same and was again treated. The patient, who lives at a distance, was advised to have bladder dilatation with silver nitrate once a week. Her last report, February 14, 1928, states that she feels very well and is only occasionally conscious of a little inflammation.

Relieved but not cured.

Case 3

Mary T., female, age forty-six, May, 1926.

For about one year this patient had suffered from frequency and had to get up as many as ten times at night. Cystoscopy showed five or six red areas on the dome of the bladder, one or two of which showed small ulcerations. At 4 ounces distention these areas bled freely. A culture was negative. June 5, 1926, under sacral anesthesia, the red areas were fulgurated. On June 11, the bladder held 10 ounces without pain. Since that time the patient has had periods during which her symptoms were as bad as ever. She has been fulgurated in the office four times, each time with marked relief. She was last seen on February 15, 1928. She said she was pretty comfortable and had nocturia three to four times. Cystoscopy showed a cicatricial ridge across the dome of the bladder, at one edge of which was a deep red area with fibrin adherent. This patient has been kept comfortable by treatments, with increasing periods of comfort between treatments.

Case 4

Louise W., July, 1926, age forty-seven.

For twenty-five years she has had intermittent attacks of bladder discomfort, and for three years has had it for most of the time. She has to void every hour, both day and night, and has stabbing pain in the urethra. The bladder capacity was only 3 ounces. She had consulted a great many urologists, and 6 months before I saw her a right kidney infection was found. The urine was normal when I saw her. Cystoscopy showed two areas of submucous fibrosis; one on each side of the bladder floor just above the ureter. The urethra was beefy red and bled easily.

July 23, 1926. Under gas-oxygen, the reddened areas were fulgurated and the urethra dilated and cauterized. She was given a number of office treatments consisting of bladder and urethral dilatation. Her bladder held from 6 to 10 ounces. The stabbing pain was entirely relieved but she continued to have considerable frequency.

December 28, 1926. The ulcer in the right base was again fulgurated. The ulcer in the left base was quite well healed.

April 12, 1927. Patient reports that she slept for 6 hours last night without voiding. Her capacity is 7 ounces. She feels quite comfortable. She went abroad for 6 months, and while in Paris consulted Legeau who thought her urethral condition was the chief cause of her symptoms.

December 19, 1927. The patient reports that she is pretty comfortable. Cystoscopy shows no reddened areas in the bladder but in the region where the ulcers had been, the mucosa was pale and traversed by telangiectases. Her capacity was 6 ounces. She started off on a trip around the world.

Relieved of her discomfort and to a considerable degree of her frequency.

Case 5

Charlotte W., March 20, 1928, age fifty-seven.

For 10 months the patient has been having periodical attacks of pain referred to the urethra, coming on when she is on her feet.

December, 1927. She had a caruncle removed without relief. She has a frequency of every 2 hours by day and voids from one to three times at night. Cystoscopy: Capacity 5 ounces. Bladder generally normal. In the anterior wall there is a definite, sharply outlined

reddened area, about 0.5 cm, in diameter, with slight loss of superficial tissue. Some dilated capillaries radiate from this area. The urethra appeared normal.

March 23, 1928. The area was slightly fulgurated. I was forced to stop the treatment because of pain before I had produced any visible necrosis in the tissues. In spite of this fact the patient reported a month later that she had been pretty comfortable ever since the treatment. This was a case of single ulcer of relatively short duration. For a month after the fulguration the patient had no pain at all. She then began to have slight discomfort; cystoscopy showed the lesion to consist of a pale area dappled with red. She will undoubtedly require further treatment.

In brief, the treatment of these 5 cases by electrocoagulation of the infected area, together with regular dilatation of the bladder and uretha, has resulted in marked improvement in all. The symptoms tend to recur, but with each recurrence the number of treatments required to give relief becomes less. In view of the fact that resection of the bladder, or even cystotomy and electrocoagulation, may be accompanied by considerable risk and has, furthermore, only a 50 per cent chance of producing a cure, I believe that all but the most advanced cases should be treated by electrocoagulation through the cystoscope and by appropriate office treatment.

CONCLUSIONS

1. There appears to be enough evidence that submucous fibrosis is due to an infected focus to warrant careful exclusion of such foci.

2. Submucous fibrosis is usually accompanied by a condition of the urethra which requires treatment.

3. Electrocoagulation practised through the cystoscope and supported by urethral treatment is the most satisfactory method of managing these cases.

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DISCUSSION

Dr. CHARLES M. MCKENNA (Chicago): I was greatly interested in what Dr. Boyd had to say in his report. At the present time we are dealing with a case that corresponds in detail with this case, and up to date we have not made a suprapubic drainage but have depended entirely on the retention catheter.

The case I refer to came to my office apparently in a great deal of pain, and suffering with a frequency of urination, but could only pass a few drops at a time. In fact, he had all the symptoms of a patient suffering with a stricture or a hypertrophied prostate. I was surprised when I was able to pass a No. 16 catheter and remove 500 cc. of residual urine. The patient was pyelogramed and the left kidney was found to contain 75 cc. of fluid while the right one showed 40 cc. of fluid. At the time he left the hospital he was able to urinate freely about every two and one-half hours.

I should like to add in conclusion, that in all cases of hydronephrosis, whether it be associated with a paralysis of the bladder, stricture of the ureter or any other entity, we elevate the head of the bed 8 to 12 inches. I should like to know what objection there is to draining those cases with a retention catheter provided the patient will endure the same.

I was very glad to have heard Dr. Boyd's paper and have gained some good points thereby.

Dr. JOSEPH F. MCCARTHY (New York): Dr. Boyd has presented for our consideration, a subject to which wholly inadequate attention has been accorded by urologists in general and myself in particular. Dr. Cahill of our department who also has a very large surgical service at Bellevue, recently read a paper on this subject. He stated that the worst treatment that could be given these patients was catheterization. He also stated that

most of these cases resumed automatic control and that the ideal care of such cases was manual manipulation. I am wondering if there might not be some compromise procedure in these non-infected cases, where manual manipulation was applicable to certain cases, say, of the non-infected type and the procedure recommended by Dr. Boyd applicable to others of the infected type.

Dr. JONATHAN E. BURNS (Kansas City): I was particularly interested in Dr. Hagner's paper in regard to spina bifida occulta, having had two cases in children, a little boy and girl, similar to the one he described, and lately one in a man aged fifty, whose symptoms began about five years ago. Difficult urination was the first symptom and he had to assume a sitting posture in order to empty his bladder satisfactorily. This condition has kept up ever since and for two years he has had complete loss of sexual power. On physical examination, the lumbo-sacral rhomboid was covered with hair, which I think is usual in these cases. On x-ray the spina bifida occulta was readily seen. On lateral x-rays the body of the fifth lumbar vertebra was pushed forward and downward over the top of the sacrum. This man had spasticity of the vesical sphincters and about 50 cc. of residual urine. His urine was infected. The urinary infection has cleared up, but, of course, the other condition remains about the same. He has the usual treatment of prostatic massage and bladder irrigation and dilatation of the urethra. His residual urine has somewhat decreased.

I sent him to Dr. Dickson, the orthopedic surgeon, and he advised putting the man in a cast, to see if the pressure could be relieved, but as yet this has not been done.

Dr. WILLIAM C. QUINBY (Boston): I have been very much interested, gentlemen, as you all have, in this presentation of these reports. The time being short, I wish merely to speak a word on the communication of Dr. Hagner and then one on that of Dr. Boyd.

Spina bifida occulta is much more common than has been

appreciated in the past, and in the last ten years, shall we say, or fifteen, it has attracted the attention of both pediatricians, neurologists and urologists. In any individual case the results of treatment will inevitably depend on the degree of congenital nerve defect which has occurred. In some instances there are no accompanying nervous disturbances and in such the diagnosis will only be made as a casual x-ray finding. More often the cases will be seen first in childhood because of the occurrence of certain symptoms, such as pyuria, or trophic nerve lesions located in the feet. Such cases will fall into the category of those described by Dr. Hagner. Others, however, may not appear for diagnosis until adult life. There have been two such adults in our clinic this last winter—people who came for investigation because of pyuria or incontinence of urine. On examination one finds evidence of a bladder which does not entirely empty and on neurological examination one finds either in the lower extremities or perineum, areas of anesthesia. In the least marked cases we may occasionally hope for relief by an exploratory operation on the sacrum. If one makes an injection of lipiodol into the dural sac, one sees a definite abnormality. Instead of coming down to a definite point, as is normal, the dural sac is spread out in whatever irregular way may be the case according to the individual deformity. Opening the back of the sacrum one finds this area is filled with peculiar colored fat and imbedded in this are various nerves. In one or two instances that I know of personally, there has been improvement in the paralytic symptoms by freeing these nerves. The subject is an exceedingly interesting one which we must all be on the lookout for, and in which, when the lesion is not too severe, there may be expected some benefit by operation.

In regard to the communication of Dr. Boyd, I merely want to say this: That the last word is by no means said on the subject yet. I appreciate his communication highly. It is a very important one and considered in splendid detail. I must, however, disagree with him in many points which he makes. For instance, one point he makes is that following overdistention of the bladder there will occur renal infection and loss of renal function. As a matter of fact, the bladder is larger than normal, caused by loss

of tonus; it is a paralyzed bladder. The filling of such a bladder does not mean the usual increase of intravesical pressure, and therefore upward propagation of infection is not an inevitable corollary. For instance, there has been a very interesting case in Dr. Cushing's clinic last summer of a preparatory school boy who on diving, hit the bottom and you may say broke his neck, although there was very little in the way of bony lesion evident. There was evidence of severe trauma to the cord in the cervical region with attendant paralyses including that of the bladder. A laminectomy was done by Dr. Cushing. He continued to empty the bladder automatically until March when with increasing recovery and accompanying increase of vesical tone he went through this infection of which Dr. Boyd speaks. In this instance it did not occur until several months after the injury. By means of renal lavage at intervals for a couple of months, the attack of renal infection has subsided; the urine is again sterile; and the amount of residual urine in the bladder slowly growing less. He is already partially ambulatory and seems likely to make a very gratifying recovery. His bladder has never been opened by permanent drainage.

Dr. Hermon C. Bumpus (Rochester, Minn.): I would like to record a case which Dr. Kretschmer and I had together. This woman had a submucous fibrosis which was electrocoagulated several times during the last few years by both of us. Dr. Kretschmer being away, she recently returned to our clinic and requested that another fulguration be made. There had been a lapse of eight months since the last treatment and the symptoms had recurred. I did this very cautiously because of the previous electrocoagulations and did not coagulate deep. In twenty-four hours the patient developed marked signs of paravesical infection and died on the third day with peritonitis. The autopsy showed that I had not perforated the bladder but frequent fulgurations before had so interfered with the blood supply of the bladder that even this slight coagulation had caused a complete sloughing of that portion of the bladder.

How are we going to treat these cases after we have cured them several times by electrocoagulation?

Dr. ALEXANDER R. STEVENS (New York): Regarding Dr. Culver's paper, we have had a rather extraordinary experience at Bellevue in having had three cases within the last four months of extravesical tumors pressing on the bladder and causing very marked urinary symptoms. Those cases will be reported in some detail later.

Concerning Dr. Hagner's paper, we have occasion to see at Bellevue Hospital, quite a few cases of spina bifida occulta so diagnosed from the x-ray plate. We make a point there of always cystoscoping such patients if there be urinary symptoms. The outlook for spina bifida occulta, if that is the only case of the distended bladder, is bad. We have had one case, a boy of about ten years, in which we found normal ureter orifices and in spite of that fact, were able, by putting iodin into the patient's bladder, to get complete outlines of the much distended ureters and pelves. In that case there existed a contracture of the vesicle neck. We operated on him, excised a wedge from the bladder outlet and reduced the residual urine to 1 ounce.

Dr. ARTHUR L. CHUTE (Boston): If I may speak for just a moment, I want to put on record a case that has to do with the one that Dr. Boyd mentioned. I think it was eight or ten years ago that I saw with two consultants, a young woman who they felt sure had a transverse myelitis. She had a retention of urine with a moderate infection of her bladder. The consulting neurologist said that one of two things would probably happen: That if the myelitis kept on extending she would die of that process; that if it did not, she would probably die of the pyelonephritis and they, therefore, suggested that I open the patient's bladder as giving her the best chance for recovery. I put her on suprapubic drainage, which was continued for six weeks, by which time the exudate about the area of myelitis had apparently begun to clear up. At any rate, I took out the tube, the incision closed, the patient was able to empty her bladder and she made a good recovery. That was some eight or ten years ago. One of her physicians told me recently that this woman is married, has had two normal children, and has gone on perfectly well. With

the gravity of the prognosis in the case, cystostomy seemed to me the only thing to do; it at least worked well in this instance. It was the opinion of the consultants that if it had not been done, the patient would have died.

Dr. WILLIAM A. FRONTZ (Baltimore): There are two points in connection with Dr. Smith's paper which I would like to discuss—first in regard to the recognition of the lesion which as a rule should offer little or no difficulty. These patients give a history which is almost typical of the lesion. There is marked urinary frequency as a rule, and when the bladder becomes distended some suprapubic pain. The urine is often perfectly clear. The essential and predominating lesion in these cases is not mucosal one, but one which is confined to the submucosa. If you cystoscope these patients without general anaesthesia there will be found a marked reduction in the bladder capacity, it frequenty being impossible to introduce more than one or two ounces of fluid. A careful search of the bladder may be negative for abnormal findings. If, however, under deep anaesthesia, the bladder be subjected to overdistension, it may approach normal capacity. As a result of this overdistension bleeding fissures are found at the site of the lesion. The lesion being replaced by fibrous tissue is inelastic and attached to the overlying mucosa and when subjected to overdistension, ruptures. I think this is a very important point because it serves to delineate rather accurately, the extent of the lesion.

In regard to the treatment, our views are in complete agreement with Dr. Smith's. We no longer resect these bladders; because of the great tendency to recurrence of the lesion, our feeling is that very satisfactory results are gotten by fulgurating the area which is torn by overdistension. Recently I have had two patients who have given histories of years of intense frequency almost amounting to incontinence who received immediate relief following fulguration. They were no sooner out of the general anaesthetic than they remarked about the tremendous improvement both as regards urinary frequency and suprapubic discomfort.

I should like to record a case similar to that cited by Dr.

Bumpus in which following fulguration with the bipolar current there was a fatal peritonitis. Since this accident I have employed the unipolar current which is less destructive and which seems to handle these cases quite satisfactorily without the risk of burning through the bladder wall.

Dr. HERMAN L. KRETSCHMER (Chicago): I was awfully glad to hear what Dr. Bumpus had to say about the dangers of fulgurating these ulcers. As we all know, they are chronic, they keep coming back. We fulgurate them and they have temporary relief and then they come back. It seems to me the treatment is not so free from danger as we might think. It still remains a question, as Dr. Bumpus said, of what are you going to do about it.

Dr. Boyd's article interested me very much. I do not see any difference from the standpoint of fundamental principles between a patient who has a prostate with obstruction and infection and dilatation or a patient who has tabes, let us say. If the tabetic has residual urine and an infection and obstruction and is going to die, why not open and drain him? It seems to me a perfectly justifiable procedure. I do not mean that as a routine. Dr. Chute told how patients might have a transitory bit of trouble relieved with drainage. I am talking of severely infected bladders where patients have chills and fever; I see no objection to draining them on the same fundamental basis that you do for men with prostate. We have done so in three cases, feeling we have saved the lives of the patients and prolonged their lives. Their urines have cleared up and they are doing fine. I see no reason why we should not do that.

Dr. FRANCIS R. HAGNER (closing): There is just one point I would like to mention in this case that I reported because I just made a few notes. This child had no other nerve lesion and neither has the little girl that I spoke of, except the involvement of the bladder and rectum. This boy had a rather peculiar condition of the sacrum. The sacrum was bent directly to the right side over in that way and on the left side you could stick

your fingers in the muscle about that far, there being no sacrum on that side at all.

Regarding operation in these patients, Dr. Kerr, who is a prominent neurological surgeon, saw these patients and he decided against operation. I think if anybody looks at the fat pad which contains these nerves and finds there is any possibility of doing anything for that, I would like to know what it is. The nerves are broken and the whole fat pad is just infiltrated with these small nerves.

I have recently seen a case of spina bifida occulta in an adult. I haven't been over the man carefully. He just came into the office claiming loss of sexual power and some difficulty in urination. I haven't studied that case yet.

I was very much interested in Dr. Boyd's patient. You all remember that during the war it was the order not to catheterize any of the patients on account of infection. Dr. Quinby says there is just bladder paralysis and no distension; they all get hydronephrosis and pyelonephrosis and pyoureter; no matter whether there is distension or obstruction, the same pathological condition occurs in the individual and I believe firmly that Dr. Boyd has hit the keynote of the treatment. I believe if all of these patients were opened at once, they would have a whole lot better chance of living longer, rather than allowing them to become dilated and later infected, which they all do.

We recently had a patient, a man, who had a tumor of the cord, the lower cord. That was diagnosed by lipiodal and laminectomy done and the tumor removed. The man had a small amount of residual urine before operation. I cystoscoped him and he had every evidence of a spinal bladder. A continuous catheter was kept in for three weeks then he got intolerant of that. We opened this man's bladder and put in a suprapubic drain. The drain was kept in for about six weeks longer and was then taken out. I might say first that the man had absolute retention after the operation. The suprapubic drain was taken out at the end of from six to eight weeks and that patient today has perfectly clear urine and absolutely empties his bladder. I believe if we had a continued frequent

catheterization and he had developed dilatation of his ureters and his pelvis, unquestionably he would have had upper urinary infection. I am not at all sure but we may come to the time when we will open the bladder in all spinal injuries, to prevent upper urinary infection.

Dr. EDWARD L. KEYES (New York): A distinction must be made, I think, between traumatic and other paralyses. The traumatic with the prospect of the "automatic" bladder frequently do well under Colonel Besley's system, because they are anesthetic and get an "automatic" bladder. The anesthesia permits them to stand the distension of the bladder while it is in retention. The other cases which do not have anesthesia have to be treated in a way Dr. Hagner suggests, whether they are going ultimately to develop an "automatic" bladder or not.

Dr. MONTAGUE L. BOYD (closing): It has been shown that automatic micturition frequently does not empty the bladder, and we cannot escape that fact, which Dr. Kretschmer has just illustrated, that the proper treatment for urinary infection is drainage, especially when there is retention of urine. When each of these cases is studied in that light, I think that more suprapubic cystotomies are going to be performed.

Dr. GEORGE GILBERT SMITH (closing): I am glad these two cases of fatal result following electrocoagulation have been mentioned because while that is a condition I have always had in mind I have never seen it happen. It seems to me that where a case has been fulgurated so much there is danger of that and the obvious thing is to open the bladder and resect the area, if possible, or, if not, to do, as Furness has advised, an electrocoagulation with the bladder open, followed by suprapubic drainage.

THIRD DAY, MAY 2, 1928

THE INCIDENCE OF STRICTURE OF THE URETER

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Recent articles concerning the incidence of stricture of the ureter found at necropsy would lead one to believe that they are common, the percentage of incidence varying from 3 to 90. The material studied, however, has been too limited, both as to number and selection of cases, to afford a comprehensive survey of the question. A close analysis of the cases reported shows that many of them are not confined to the type of stricture which urologists have recently described clinically. In order to determine the incidence of strictures that cause obstruction to the introduction of a catheter or sound, as well as of the so-called wide stricture, further investigation of a large series of ureters removed at necropsy seemed necessary. To attain even approximate accuracy in such analysis it seemed to us that material available in a general hospital, where all types of diseases occur at all ages, should be studied. We therefore instituted a series of postmortem examinations and are reporting our observations so far as they have been carried out.

One of us (Frater) completely removed both kidneys and ureters in 93 unselected cases at necropsy. The organs were inspected in situ, and then removed either intact or with the kidneys detached above the ureteropelvic juncture. Fifty-eight of the subjects were males and 35 were females. Each decade of life up to the eighth was represented, including 7 in the first decade.

Roentgenograms were taken of the kidney and ureter in 14 cases and of the ureter alone in 32. The ureter was filled by gravity with a column of fluid (30 per cent sodium bromide) held 37.5 cm. above the level of the ureter.

After the length of the ureters had been noted, olives attached

to a flexible steel guide were passed up the ureter. The size of the olive causing obstruction, and the site of the obstruction, in terms of distance in centimeters from the ureterovesical orifice, were ascertained. In passing the bulbs care was taken not to use too much pressure. The bulbs were passed from No. 8 French up to the size producing obstruction in sequence. Thus, if obstruction to a No. 14 French was noted, it indicated that a No. 13 French bulb did not meet with obstruction. A section of the ureter about 1 cm. in length was removed from the site of obstruction and six sections were made through this area after it had been embedded in paraffin. The sections were stained with hematoxylin and eosin and van Gieson's stain for fibrous tissue and were examined microscopically.

It should be stated that of the 93 subjects studied 40 were embalmed and 53 were not. Of those that were embalmed, none was examined more than ten or twelve hours after death, most of them being examined four or five hours afterward; the postmortem changes in the tissues of the ureter would, therefore, be comparatively insignificant. Furthermore, it was noted that there was not much difference in the data obtained from ureters that had been embalmed a few hours than from those that were not embalmed. Although the absence of muscle tone or reflex spasm present in the living subject might make a difference in the size of the sounds passed, still it would hardly affect the data obtained in regard to the comparative diameter of the ureter in various areas.

The average size of the bulb that met with obstruction was between No. 12 and No. 13 French. There was little difference in the sexes, or in the embalmed and unembalmed tissue. In 4 male subjects bulbs varying from No. 16 to No. 20 French were not obstructed in one ureter. In 1 male subject obstruction was not met in either ureter to No. 19 French. In 3 female subjects obstruction was not met to bulbs varying from No. 18 to No. 19 French in one ureter, and in 1 female subject a No. 20 French was not obstructed on either side. It is evident that the caliber of the normal ureter is far from uniform. It is not unusual to observe a normal ureter which will not permit a bulb larger

than No. 9 to be introduced without obstruction. On the other hand, an equally normal ureter may permit a No. 19 or No. 20 bulb to pass easily throughout. The fallacy of endeavoring to determine areas of abnormal constriction by means of measuring the caliber by a bulb, when the normal limits are so variable, is obvious. The size of the bulb which may be introduced without obstruction in the normal ureter varies from No. 8 to No. 20. Forty-four per cent of the obstructions were within the first 2 cm. of the ureter. This included the intramural portion and that immediately adjacent in some cases. The next most frequent site of obstruction was from 2 to 4 cm. from the bladder and composed 17.5 per cent. Most of the obstructions in these two groups correspond to the site of the third physiologic zone of narrowing. In the first 6 cm., therefore, 68 per cent of the obstructions occurred. According to some observers, this corresponds to the site at which stricture is most frequently diagnosed. The area, 6 to 12 cm., covers the second physiologic zone of narrowing and obstruction was met there in 18.5 per cent of the ureters.

CRITERION OF STRICTURE

A stricture is a narrowing, beyond the normal anatomic and physiologic limits, of a hollow muscular tube. The question may well be raised: What are the normal anatomic and physiologic limits?

If all ureters were of the same caliber and there were an established normal caliber, it would be a simple matter to diagnose a stricture by means of bulbs. Just as the urethra in one individual may be smaller than that in another, so normal ureters in different individuals may vary in caliber. In the same individual one ureter may have a greater diameter than the other.

Gross strictures are readily diagnosed at necropsy. They are characterized by marked localized narrowing of the ureter with dilatation above the site of the stricture. Definite obstruction to small bulbs can be demonstrated in this type of stricture. The roentgenograms will show a localized area of narrowing with dilatation above. Such areas may be congenital or acquired.

WIDE STRICTURE

In the absence of definite pathologic criteria of the so-called wide stricture it is difficult to give a detailed description of the pathologic changes involved. Microscopically a stricture may show: (*a*) changes in the epithelium, such as destructions; (*b*) narrowing of the lumen up to complete obliteration; (*c*) evidence of inflammatory reaction, such as lymphocytic and leukocytic collections in the wall of the ureter; (*d*) increase in fibrous tissue at the expense of the muscle bundles, or an increase of the fibrous tissue normally present, and (*e*) hyalinization of muscle.

In congenital strictures absence of inflammatory reaction will be noted; this may also be noted in the acquired strictures if the process is of long standing. The epithelium may be unchanged in a stricture of moderate degree.

In intrinsic acquired stricture of the ureter the constriction is the result of healing of an injury (used in its widest sense), which has taken place not by resolution but by fibrosis. The fibrosis may be either primary or secondary, the primary taking place without antecedent ulceration, the secondary being the method of healing following ulceration. If sufficient fibrosis occurs following the initial injury and contraction of the fibrous tissue follows, a stricture may result. Localized areas of fibrosis may occur in the wall of the ureter, without as a rule causing diminution of the lumen. These areas of localized fibrosis, although possibly indicative of previous infection, are not diagnostic of stricture.

In determining any abnormal change in the mucosa, fibrous tissue or musculature of the ureter, one should first become familiar with the variations that are normally present. In studying a series of normal ureters microscopically in sections stained by fibrous tissue stains, the large amount of fibrous tissue normally present is apparent. It will vary considerably at the same level in different subjects, and in the same ureter at different levels, since it increases in amount over sections nearer the ureteropelvic juncture. The width of the mucosa also shows considerable variation at different levels, being much more marked in the up-

per half of the ureter. Likewise the musculature is variable in different subjects at the same level and in the lower half of the ureter an outer longitudinal muscle layer is visible, which is absent in the upper half. In different subjects the musculature may be better developed in one ureter than in the other. In estimating any abnormality in the mucosa or increase in fibrous tissue or hypertrophy of muscle, therefore, comparison with normal variations is essential.

In determining the degree of obstruction that may be present in a ureter before it should be regarded as due to stricture, several anatomic factors must be considered. As noted, there is a large variation in the size of bulbs that the normal ureter will admit. Recognition of the normal areas of anatomic narrowing is essential. In embryos up to 125 mm. total length the ureter is an almost straight tube of even caliber throughout, but slightly later in embryologic life three areas of narrowing occur: one at the ureteropelvic juncture, the second where the ureter crosses the linea innominata between the true and false pelvis, and the third just above the entrance to the bladder. Among these areas of narrowing fusiform dilatations may occur: (*a*) in the lumbar spindle between the first and second narrowings; the lumbar spindle is present in embryos of a little more than 125 mm. total length and is abdominal, and (*b*) the pelvic spindle, between the second and third areas of narrowing develops in embryos of 320 mm. total length; the pelvic spindle is inconstant and may be completely lacking after birth. The lumbar enlargement is never absent in embryos of more than 125 mm. and in children may taper off gradually above and below, in which case the upper and middle narrow parts are only indistinctly seen and the middle may be absent. In most of the cases in the series these physiologic areas of narrowing and the intervening spindles were noted, although in some the pelvic spindle, and in others the lumbar spindle, was absent. In a few neither spindle was present.

One cannot conceive of a narrowing sufficient to be labeled stricture without a recognizable increase in fibrous tissue. The converse, however, does not hold. One of us (Braasch) has frequently emphasized the clinical importance of recognizing the

existence of "inflammatory or atonic"dilatation of the ureter. Israel, Alksne, Andler, and other observers have referred to such dilatation as a result of atony. With dilatation of this type all the changes in the wall of the ureter which occur as the result of stricture may be present except the narrowing of the lumen. Sections of the ureter will then show an increase in fibrous tissue, degeneration of muscle, lymphocytic collections, degeneration of epithelium, and yet may admit bulbs as large as No. 20 French throughout the length of the ureter with the greatest ease.

Small collections of lymphocytes or leukocytes scattered in the wall of the ureter were noted; these were not accompanied by any fibrous or degenerative changes in the surrounding tissues, or with constriction of the ureteral lumen. The areas were observed in the different layers of ureteral wall, the majority being situated in the submucosa or musculature. The few areas that were noted in the mucosa did not cause other destructive changes or offer resistance to the passage of a bulb. In the absence of the two essential features of stricture it is difficult to interpret their presence. Although a collection of lymphocytes often indicates an inflammatory process, it cannot always be so interpreted. Lymphocytes are frequently observed in various organs in elderly adults and may then be a manifestation of the generalized degenerative process of age. Their presence alone never justifies the diagnosis of stricture, even if slight localized fibrotic changes are also present, unless there is evidence of destructive changes in the mucosa and narrowing of the lumen.

In this series of 93 necropsies actual stricture of the ureter was found in only 2. Neither of these was of an infectious nature: one was the result of extra-ureteral carcinoma and the other was congenital. A so-called wide stricture of inflammatory origin was not found in any of the subjects examined. In the first case there was gross evidence of marked compression of the middle portion of the ureter by metastatic carcinoma, with resulting hydro-ureter and hydronephrosis above, and a small stone. Microscopic study of the site of the stricture showed: (*a*) increase in fibrous tissue; (*b*) great narrowing of the lumen; (*c*) atrophy and replacement of muscle bundles by fibrous tissue;

(*d*) collections of lymphocytes in the wall of the ureter, and (*e*) destruction of the epithelium.

In the second case there was an extremely small ureteral orifice, causing obstruction with resultant ureterocele, hydro-ureter and hydronephrosis in the upper segment of a duplicated kidney. The meatus was extremely small and a pointed No. 4 catheter was introduced with difficulty. Serial sections made through the opening did not show an inflammatory process. It seems logical to assume that the partial occlusion of the orifice was the result of congenital stricture.

Besides these 2 cases, there were 14 which showed evidence of renal or ureteral lesions. Among these there were several showing dilatation of the ureter without etiologic narrowing of the lumen. One case showed marked ureteritis without stricture; another, carcinomatous infiltration of the wall of the ureter causing dilatation of the pelvis. In 2 male subjects definite pyelectasis without ureteral obstruction or dilatation, and in 1 subject moderate dilatation of both ureters and pelvis, the latter containing sand, was noted. In 1 female subject (primipara) there was marked dilatation of the upper half of the ureter without any evidence of previous or present inflammation and without stricture. In another female subject (multipara) there was bilateral ureteropelvic dilatation without stricture. There were 4 cases of pyelitis and 1 of suppurative nephritis without any evidence of stricture in the ureter. There were 2 cases of ureteral stone, in which the ureter was normal and did not show evidence of stricture on microscopic study. Thirteen cases showed lymphocytic collections in the wall of the ureter without any increase in fibrous tissue or narrowing of the lumen.

ILLUSTRATIVE CASES

Case 1. A congenitally small meatus. The patient, aged fifty-five, (tripara) had suffered from stomach trouble for a year. A history of symptoms referable to the urogenital organs was negative except for nocturia, graded 1. Urine contained pus graded 1 (4 cells to the high-power field). At operation a duodenal ulcer was excised and appendectomy performed. Death was due to pulmonary embolus. The

right kidney showed complete duplication of ureter and pelvis. The ureter from the upper pelvis was tremendously dilated, as was the

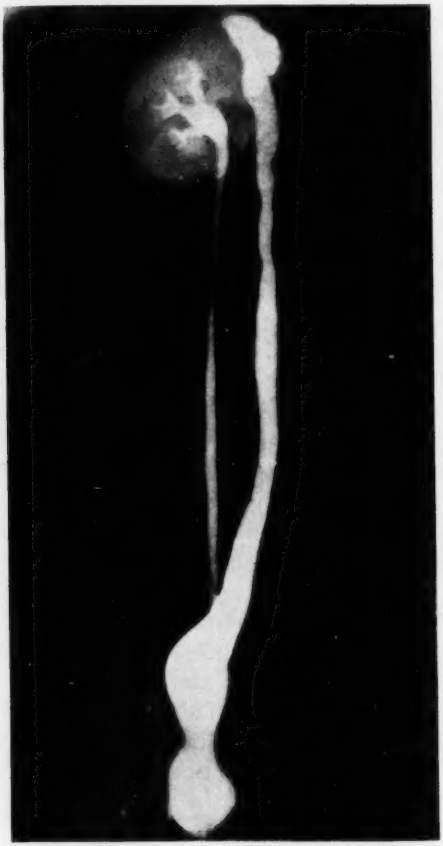

FIG. 1. URETEROCELE IN THE PRESENCE OF A CONGENITALLY SMALL MEATUS, HYDRO-URETER AND NEPHROSIS IN UPPER HALF OF DUPLICATED KIDNEY

pelvis. The meatus was pin-point in size and a large ureterocele was present (fig. 1). Serial sections through the opening did not reveal inflammatory reaction.

Case 2. True organic stricture caused by pressure of metastasis. The patient, a woman aged sixty-four (quintipara), complained of upper lumbar pain, girdle-like in distribution and continuous in character. A history of urogenital symptoms was negative. Necropsy revealed

FIG. 2. STRICTURE OF MIDDLE PORTION OF LEFT URETER, WITH DILATATION OF URETER AND PELVIS

carcinoma of the head of the pancreas with multiple areas of metastasis. The kidneys, ureters, and bladder were removed intact and a roentgenogram made (fig. 2). The right kidney and ureter were normal, but the left showed an area of marked narrowing 16 cm. from the bladder.

FIG. 3. GREAT INCREASE IN THICKNESS OF URETERAL WALL WITH INCREASED FIBROUS TISSUE AND LARGE LUMEN, WHICH ADMITTED A NO. 20 FRENCH OLIVE WITH THE GREATEST EASE. × 18.

Above this area the ureter and pelvis were definitely dilated. There was no obstruction to a No. 19 French olive in the right ureter, and the left ureter admitted a No. 5 French catheter but not a No. 8 French bulb. Above the stricture a small calculus was found. Sections through this area showed a greatly compressed lumen and increase in fibrous tissue; carcinoma cells were not found in the wall of the ureter, although they surrounded it. There were several areas of lymphocytes.

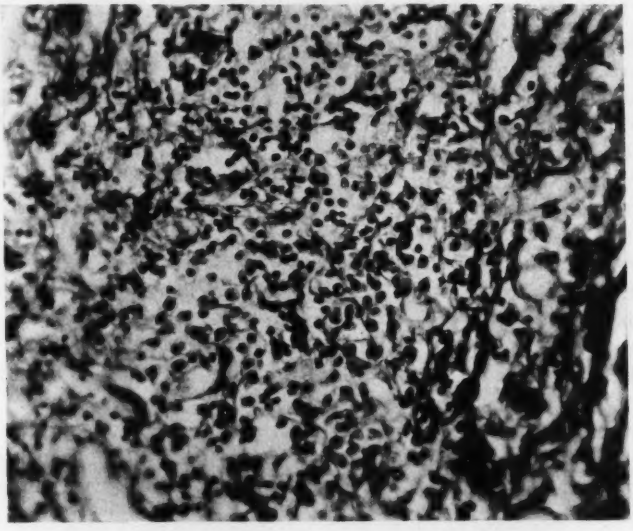

FIG. 4. SAME CASE AS THAT IN FIGURE 3. LYMPHOCYTIC COLLECTIONS. × 200

Case 3. Marked changes in the wall of the ureter without narrowing of the lumen. A man, aged forty, gave a long history of renal lithiasis. Right nephrolithotomy had been performed three years previously. He was uremic on admission and died shortly afterward. Necropsy revealed bilateral pyonephrosis with lithiasis. Both ureters were markedly thickened. The right ureter admitted a No. 20 French olive without obstruction. Sections through this ureter at various levels showed a huge lumen and a very thick ureteral wall with increase in fibrous tissue. The muscle bundles showed degeneration and in part replacement by connective tissue. There was marked infiltration by

lymphocytes and leukocytes. The epithelium was retained in part and was squamous in character (figs. 3 and 4). The left ureter showed obstruction to a No. 13 French olive 8.5 cm. from the bladder. Sections through this area were similar to those on the right side, but with less change.

Case 4. Ureteral calculi without stricture. A man, aged fifty-two, complained chiefly of angina pectoris. A moderate degree of nocturia had been present. Urinalysis showed pus graded 1 (4 cells to a high-power field). At necropsy the ureters and kidneys appeared grossly normal. A calculus was palpated in the left ureter 13 cm. from the ureteropelvic juncture. The right ureter offered obstruction to a No. 13 French olive 11 cm. from the bladder and the left 8 cm. from the bladder. Serial sections from this area in the left ureter did not show abnormality, and those from the right showed a few small lymphocytic collections in the fibrous sheath, but were otherwise normal.

Case 5. Obstruction due to interference with peristalsis without decrease in the size of the lumen. A man, aged sixty-nine, complained of abdominal pain of six months' duration. A moderate degree of nocturia had been present for the last four years. Urinalysis was practically negative. At necropsy carcinoma of the right suprarenal gland, with metastasis to the mesenteric lymph nodes was found. The left renal pelvis showed dilatation graded 2; the right was grossly normal. The left ureter presented obstruction to a No. 17 French olive 10 cm. from the bladder. Sections at this point and at various other points in the ureter showed marked infiltration of the ureteral wall with carcinoma cells, without any increase in the fibrous tissue.

The ureter admitted a No. 16 French olive, yet there was dilatation of the pelvis. This case illustrates atony of the ureter from a rare cause: interference with peristalsis from carcinomatous infiltration of the ureter in practically its whole length. This was discovered only on microscopic examination.

Case 6. Dilatation of the ureter without obstruction. A woman aged thirty-one (primipara) complained of symptoms suggestive of brain tumor. There was a history of occasional nocturia; the urine was normal. Necropsy disclosed malignant neurofibroma. A roentgenogram (fig. 5) showed dilatation of the upper half of the right ureter. Obstruction to a No. 13 French olive was encountered on the right 1.5

cm. from the bladder; a No. 17 French olive was not obstructed above this point. On the left there was obstruction 8.5 cm. from the bladder

FIG. 5. DILATATION OF UPPER HALF OF RIGHT URETER, WITH PYELECTASIS
Stricture was not present on microscopic examination

to a No. 14 French olive. Sections from the sites of obstruction, as well as at the point of dilatation, were normal.

SUMMARY AND CONCLUSIONS

1. The incidence of lesions in the ureter is greater than has been previously recognized.

2. The infectious origin of stricture of the ureter is not so common as recent articles would infer, as is shown by the fact that stricture of this type was not found in ninety-three necropsies.

3. The caliber of the normal ureter as ascertained by the passage of bulbs varies from No. 8 to No. 20 French.

4. The most frequent site of greatest anatomic narrowing in the normal ureter is in the first 4 cm. from the ureteral orifice, which corresponds to the area in which most strictures have been reported.

5. Lack of symmetry in the two ureters was common. In several instances the caliber of one ureter was 50 per cent greater than the other, both being normal on gross and microscopic examinations.

6. Owing to the variability in the caliber of the lumen of the normal ureter, the difficulty of recognizing a stricture by means of bulbs or sounds larger than No. 9 French is obvious.

7. The demonstration of areas of ureteral dilatation, even when occurring proximal to a portion of the ureter with a comparatively small lumen, does not necessarily indicate stricture. The dilatation in such cases may be atonic, and the result of intrinsic cicatricial changes in the wall of the ureter.

8. Microscopic areas of lymphocytic infiltration regarded by some observers as indicative of stricture cannot logically be so classified, since they lack all of the gross and microscopic criteria of stricture.

9. That stricture is not necessary to the formation of renal or ureteral stone is shown by two cases of the series in which evidence of a lesion in the ureter could not be found on gross or serial microscopic section.

10. In at least eight cases in the series there were some symptoms of urinary disturbance and several in which some tenderness was discovered on palpation of the ureteral area. In none of these could any evidence of ureteral stricture be found.

11. In none of the cases was there evidence of the so-called wide stricture. If, as has been claimed, such strictures are common, one must infer that they may exist without leaving any trace of their existence, even in microscopic sections of the wall of the ureter.

12. That stricture of the ureter of infectious origin does occur is recognized by everyone. Although the material in this study is inadequate to determine the frequency of its occurrence, it nevertheless shows that (*a*) the incidence of inflammatory stricture is not as great as recent postmortem studies indicate, and (*b*) the diagnosis of stricture by clinical methods now employed may be inaccurate.

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STRUCTURE AND FUNCTION OF THE URETER DURING PREGNANCY[1]

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WITH THE ASSISTANCE OF H. G. TIMBRES

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It is only within recent years that both urologists and obstetricians have taken vigorous hold of the problem concerning the condition of the ureter in pregnant women. With regard to this subject, two facts have come to be established on a firm basis through correlated clinical and experimental studies: namely, the frequent occurrence of ureteral dilatation and a certain degree of lack of tonus of the ureter, as shown by a delay in ureteric action. In contrast to the findings of former investigators, modern methods of examination, particularly pyelograms, reveal an incidence of 80 per cent and even more, of this condition (Kretschmer and Heaney, Crabtree, F. Kidd, and others), so that a moderate degree of hydroureter is at present considered an almost constant concomitant of pregnancy. Investigations conducted by Kaltenschnee showed that in pregnant women there may be seen both a delay in the excretion of injected dyes and a prolongation of the contraction intervals of ureteral peristalsis; while H. S. Pugh, in a recent communication, reports that in 100 apparently normal pregnant women examined during the seventh and ninth months of pregnancy, he noted that the ureters were very sluggish in their action in 80 per cent of the cases.

Since the presence of some existing obstruction is universally considered as the chief cause of ureteral dilatation, an attempt was made by the senior writer to find an acceptable explanation by carefully studying the morbid anatomy of the urinary tract in pregnancy, with a view of ascertaining if possible, the existence

[1] By invitation.

of some obstructive lesion in its lower portion. Such a study appeared the more desirable since accurate data along such lines are almost entirely lacking.

Upon studying the conditions obtaining in the pelvic portion of the ureter during pregnancy, we noted certain definite hyperplastic and hypertrophic changes both in the musculature and connective tissue, to which we believe attention has heretofore not been directed. Such hypertrophy is particularly pro-

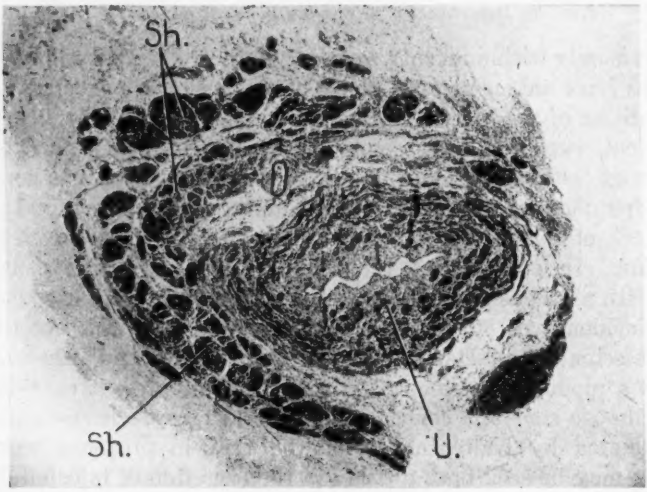

FIG. 1. PREGNANT URETER AT TERM, JUXTAVESICAL PORTION 2 MM. ABOVE URETERO-VESICAL JUNCTION

Sh. = ureteral sheath; *U.* = ureter

nounced in the juxtavesical portion of the ureter where it passes through the parametrium and lies in close contact with both the bladder and the anterior vaginal vault.

Figure 1 illustrates the findings in a section through a ureter at term, 2 mm. above its junction with the bladder. The most important feature of this picture is the excessive hypertrophy of the ureteral sheath. This hypertrophy, although invariably present, varies within certain limits in the specimens examined.

Quite often the diameter of the ureteral sheath equals or even exceeds the diameter of the ureter itself, a cleavage being visible between the two structures. As another important feature, the whole architecture of the ureteral wall appears changed owing to the presence of a considerable amount of fibroblastic tissue interspersed between the hypertrophied muscle bundles, thus creating a rather rigid structure. When compared with a normal ureter, the difference both in the thickness of the muscle bundles

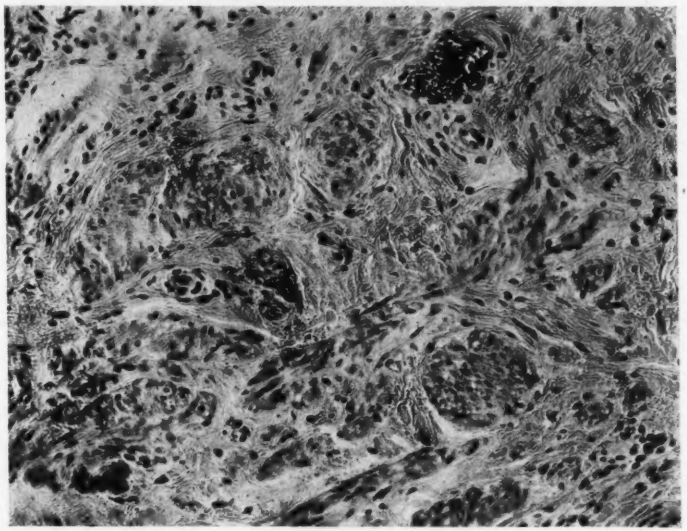

FIG. 2. PHOTOMICROGRAPH OF JUXTAVESICAL PORTION OF PREGNANT URETER
Note abundance of fibroblasts between muscle-bundles

and the development of connective tissue can readily be seen. (Consult figures 2 and 3.) The mucosa of the ureter shows a moderate thickening, due both to edema and the occurrence of young connective tissue fibers. Now and then, an accumulation of lymphoid tissue makes its appearance. The epithelium is arranged in several layers, the individual cell element having increased approximately twice in volume. Lymphocytes, plasma cells and mononuclear cells in process of wandering through the epithelium make an interesting phenomenon.

As a consequence of the interlacing of hypertrophied muscle bundles and hyperplastic connective tissue, the whole ureter gives the impression of a rather rigid organ, with its lumen narrowed due to constriction effected both by the structural alterations in its wall and by the encircling sheath.

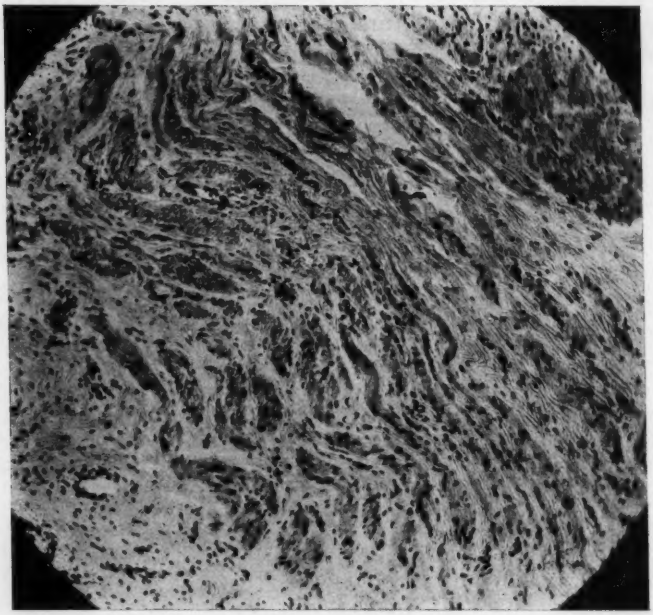

FIG. 3. PHOTOMICROGRAPH OF JUXTAVESICAL PORTION OF NON-PREGNANT URETER

The microscopic picture of the intravesical portion of the ureter in the pregnant woman shows material variations, and its most conspicuous feature consists in an intense development of connective tissue, as evidenced by the presence of broad strands of both adult and young fibers. Numerous fibroblasts make their appearance chiefly in the connective tissue spaces of the distal half of the ureteral wall and its periphery, where the markedly thickened and hypertrophied muscle bundles of the ureteral

sheath, interlaced with broad strands of connective tissue, stand out in strong relief. In addition to the fibroblasts, there can be seen at the periphery of the ureter, interspersed between the wide connective tissue bundles, groups of plain muscle fibers which display all the histological criteria of newly formed elements. The individual muscle bundles of the entire ureteral wall have undergone a degree of hypertrophy somewhat similar to that described in the juxtavesical portion; and, where the muscle structures at the ureteral opening become attached to the mucous membrane, the increase is particularly noticeable.

The study of our specimens has revealed the existence of conditions which could readily give rise to stenosis in the juxtavesical region of the ureter, and which in the main consist of a concentric hypertrophy in the entire ureteral wall, with the constriction still further accentuated by an encircling ring resulting from hypertrophy of the ureteral sheath. Since the striking increase in size of the latter is most noticeable at the junction of the ureter with the bladder, the inadequacy of the ureter as an efficient urinary duct becomes particularly marked in this locality, especially if it is recalled that a certain degree of narrowing at this point has come to be recognized as a physiological occurrence. Confirmation of our findings is afforded by the clinical observation noted first by Saenger, that the ureters can be definitely felt on bimanual palpation in the second half of pregnancy.

In calling attention to the primary importance of the hyperplastic and hypertrophic changes in the lower part of the pelvic portion of the ureter, as essential factors in the narrowing of its lumen in the pregnant woman, it is in no way my desire to underestimate the significance of congestion and edema of the mucosa as contributory factors, as it is quite in accord with prevailing doctrines that such an occurrence may turn the tide and render positive the hitherto potential obstruction of the ureter. More significant, however, in this regard, appears to be the development of an angulation of the right ureter at the distal end of its juxtavesical portion, as a result of the common dextrorotation of the pregnant uterus and of the firm attachment of the trigonum vesicae to its cervical portion; while, on the other hand, the same process predisposes to the stretching of the left ureter.

In striking contrast to the regularity of the characteristic rearrangement in the lower part of the ureteral structure encountered in our specimens, the findings in the upper part lack uniformity. The increase in size in the muscle bundles, although occasionally definite, appears by no means constant. On the other hand, the intercalation of various numbers of fibroblasts both within the mucosa and the muscular coat extends through-

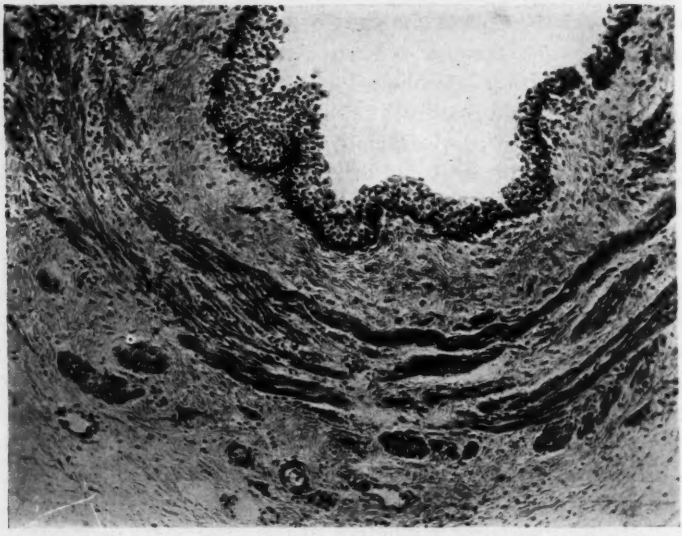

FIG. 4. PHOTOMICROGRAPH OF PREGNANT URETER 9 CM. ABOVE URETERO-VESICAL JUNCTION

out the whole course of the ureter. But the whole complex of the connective tissue in the upper urinary tract is loose and delicate, an undulating course of the loosely arranged connective tissue fibres predominating, in contradistinction to the density of structure seen in the lower urinary tract. Reference to figure 4, representing a photomicrograph of the ureter 9 cm. above the uretero-vesical junction, makes these conditions clear.

We summarize our observations by stating that histologic

evidence tends to show that urinary obstruction in pregnant women is caused by certain anatomical conditions in the juxtavesical portion of the ureter, due to hyperplastic and hypertrophic changes in the constituents of its wall. However, there was no demonstrable indication of an active inflammatory process within the ureteral wall in the specimens examined.

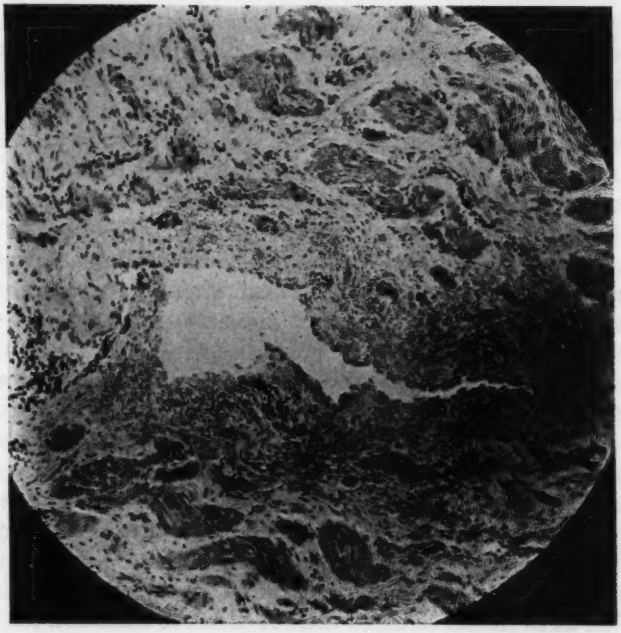

FIG. 5. PHOTOMICROGRAPH OF INTRAVESICAL PORTION OF URETER, SHOWING EFFUSION OF BLOOD BETWEEN ITS LAYERS

For a proper understanding of ureteral pathology following labor reference is necessary to the occurrence of involution processes in the ureteral wall, analogous to the phenomena occurring in the uterus during the puerperium.

In addition, attention is called to the effusion of blood between the muscle layers and within the mucosa of the intravesical and

also of the proximal end of the juxtavesical portion of the ureter in patients whose labor was terminated by rather difficult operative procedures. Such traumatic lesions developing during the course of protracted delivery offer an interesting urological problem with respect to subsequent formation of scar tissue, inasmuch as the recent study of L. D. Keyser tends to show that local injury to the ureter, such as crushing or bruising, leads to cicatrical stenosis with hydroureter above the injury.

Furthermore, it should be borne in mind that severe inflammatory reaction in the ureteral wall during pregnancy seems to favor stricture formation (Crabtree, Hofbauer).

Regarding the hypertrophic changes which occur in the trigonum vesicae during pregnancy, the reader is referred to Hofbauer's monograph on Pyelitis, in the March, 1928, number of the Johns Hopkins Hospital Bulletin.

Upon entering into the second phase of our subject, namely, the atony of the ureter, we wish to call attention to experimental work which may shed light upon the etiology of this condition in the pregnant woman.

While the essential nature of the impairment of the expulsive forces of the ureter consequent upon its marked dilatation is readily understood, no acceptable explanation has yet been adduced for the interpretation of loss of tone of the ureteric muscle in pregnant women when only slight dilatation is noticeable. The problem of relative insufficiency of ureteric action without ureteral pathology has occupied the attention of urologists for many years. Although there is still a considerable variance of opinion as to the mechanism concerned in the initiation of symptoms characterizing atony ample evidence is now available to show that certain chemicals (anaesthetics, etc.) may represent a causative factor.

In this study we have been particularly interested in the effect of highly diluted solutions of bile salts upon the automatic contractions of the ureter, since the recent work of Süsstrunk and Kleesattel demonstrated a definite increase in the bile-acid content of the blood in pregnant women. The depressing effect of bile-salts upon both the tonus and the contraction of the

uterine muscle, almost comparable to the effect of narcotics, has lately been determined by the senior writer in another experimental study. For our present investigation, the following technic was employed. A four centimeter strip from the middle portion of a pig's ureter, or a ring preparation, was immersed in oxygenated Locke's solution, and the spontaneous contractions of the strip recorded. Then, for the next hour, the effect of the addition to 50 cc. of Locke's solution, of 1 cc., and a few experiments, of 2 cc. of a 0.25 per cent solution of sodium glycocholate (Merck) on the ureteric activity was determined, as well as the response of the ureter to 1 to 2 drops of a solution of commercial adrenalin, diluted 10 times. Other drugs tested included ephedrin, pilocarpin and pituitrin.

The ureters were obtained from freshly slaughtered pigs, and were found to show their best contractions after having been kept in fresh Locke's solution in the ice-box for twenty-four hours. In general, two types of contraction were observed. The longitudinal muscle gave uniform single contractions at intervals of approximately fifty seconds. The circular muscle showed a tendency to group its contractions, some preparations giving as many as seven, others as few as two in a group, with a period of rest of about ninety seconds between the groups. Certain ring preparations, however, acted in the same manner as the longitudinal muscle, giving single regularly spaced contractions.

Our experiments invariably show that sodium glycocholate, even in proportion of one part in 20,000, causes either a diminution in the amplitude of the contractions, or a prolongation of the interval between them, or both of these effects, in both longitudinal and circular muscle of the ureters. In some of the experiments there was also a distinct diminution of tone. Furthermore, we invariably found that the preparations, having once been put under the influence of sodium glycocholate, could always be made to begin contracting again as rapidly as normal, or even more rapidly than normal, by the administration of one or two drops of a 1:10,000 solution of adrenalin. In the ring preparations which showed a tendency to group formation of the contractions, the first effect of the sodium glycocholate was to

change the character of the contractions from that of the group formation to single contractions as a rule, and then to prolong the intervals between these contractions. Adrenalin was never observed to be capable of reestablishing the group formations in

FIG. 6. GRAPHIC RECORD OBTAINED IN EXPERIMENT ON LONGITUDINAL STRIP OF A PIG'S URETER PLACED IN LOCKE'S SOLUTION TO WHICH 2 CC. 0.25 PER CENT SODIUM GLYCOCHOLATE HAVE BEEN ADDED

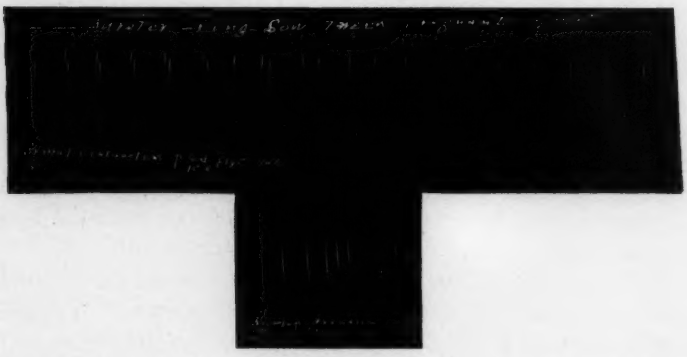

FIG. 7. RECORD OBTAINED FROM RING-PREPARATION OF PREGNANT PIG'S URETER

Note group-formation of spontaneous contractions. After the addition of 1 cc. of 0.25 per cent sodium glycocholate solution the intervals between contractions are prolonged. One drop of epinephrin 1:10,000 increases the rate of contractions.

these cases, but always produced a marked increased in the rapidity of the contractions.

With the current view of the action of ephedrin being similar to that of adrenalin in several respects, it seemed worth investigating its effect upon ureteral activity. Two drops of a 0.3 per

cent solution markedly increased the rate of contraction both in the ring and the longitudinal preparation. On the other hand, a study of the comparative pharmacological action of ephedrin and adrenalin on the ureter revealed the fact that adrenalin is a much more potent stimulant, inasmuch as this substance in-

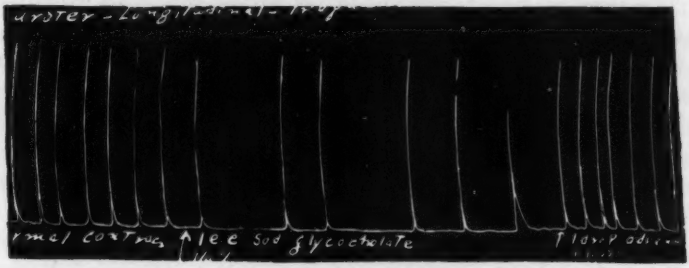

FIG. 8. GRAPHIC RECORD OBTAINED IN EXPERIMENT WITH A LONGITUDINAL STRIP OF PREGNANT PIG'S URETER IMMERSED IN 50 CC. LOCKE'S SOLUTION

Note prolongation of contraction intervals after addition of 1 cc. 0.25 per cent sodium glycocholate solution and also restoring effect of one and three drops of a solution of adrenalin 1:10,000.

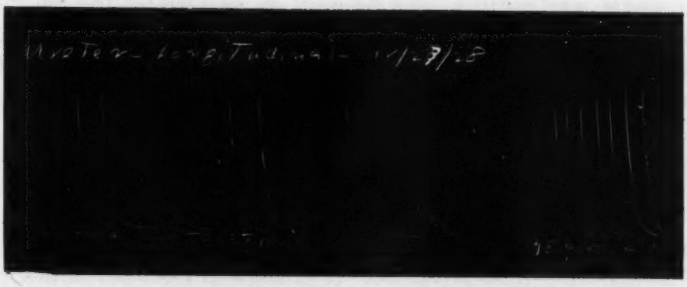

FIG. 9. SHOWING STIMULATING EFFECT OF SOLUTION OF EPHEDRIN 0.3:100 ON LONGITUDINAL STRIP OF PIG'S URETER

variably restored the rhythmic contractions after they had been abolished by saturation with sodium glycocholate; while ephedrin under these conditions occasionally failed.

In conclusion, as a matter of no little interest, there could be seen a higher degree of sensitiveness to sodium glycocholate in

the ureter of the pregnant pig as compared with the non-pregnant, in that a smaller dose of the bile salt was capable of definitely prolonging the intervals of contractions, and in some cases of even entirely inhibiting the contraction, than was generally required in the non-pregnant specimens.

The presentation of the following curves serves to exemplify the results obtained in this study.

The tracing reproduced in figure 6 shows the effect upon the automatic contractions of a longitudinal strip obtained from the middle portion of a pig's ureter of the addition of 2 cc. of a 0.25 per cent solution of sodium glycocholate to 50 cc. of Locke's solution. The depressing effect both on the amplitude and rate of contraction is apparent.

The second tracing represents the influence of the addition of sodium glycocholate on the automatic contractions of a ring preparation obtained from the middle portion of the ureter of a pig, seven weeks pregnant. The two characteristic features of the influence of the bile salt are seen first in the alteration in the character of the contractions in changing the group formation to single contractions, and second, in prolonging the interval between the contractions. The restoring effect of two drops of adrenalin (1:10,000) on the rate of contraction is seen in the second part of the tracing.

The third tracing shows the restoring effect of one drop of adrenalin on a longitudinal strip obtained from the same ureter as in the preceding experiment.

The fourth tracing, obtained from a longitudinal preparation from the middle portion of the ureter of a non-pregnant pig, illustrates the stimulating effect of 2 drops of a 0.3 per cent solution of ephedrin both on the rate and the amplitude of the normal contractions.

COMMENT

The experiments just detailed tend to show that the depressing effect of bile salts both upon the amplitude and the rate of ureteric contractions may be an important factor in offering an adequate explanation for the atonic condition of the ureter in pregnant

women. The reactions described bear a close analogy to our previous observations concerning the depressing effect of bile salts upon the contractions of the uterine muscle and to a similar action upon the small intestine, as shown by Asher. An acceptable basis for the interpretation of such phenomena is afforded by the recognized ability of the bile salts to lower the surface tension. With our newer understanding of the increase in the bile-acid content as an essential feature of blood chemistry during pregnancy, support is lent to Frank Kidd's assumption that a chemical poison in the blood may be the possible factor involved in the loss of tone in the muscle of the ureter in the pregnant woman.

The bearing of our experimental results on the sluggishness of the gall bladder and the biliary ducts during pregnancy, to which attention has been called in another paper, will be made the subject of further investigation.

The stimulating effect of minute doses of adrenalin on the ureter is very striking. In addition, our experiments tend to show that there exists not only an antagonism of the action of bile salts and adrenalin on ureteral activity, but also a rather definite quantitative relationship between these two substances in their respective effects on the automatic contractions of the ureter.

From experiments on the surviving ureter, pharmacological evidence has been furnished for the presence of both sympathetic and parasympathetic nerve endings in the ureteral wall (Satani, and others). The effect of nicotin upon the excised ureter indicates the existence of ganglion cells in the ureter itself, and our studies showed the occurrence of hypertrophy and hyperplasia of such elements. In the literature data are found indicating differences both in the irritability and response to adrenalin of various parts of the ureter, its upper and middle portion being much more responsive than the lower end. On the other hand, the rather transient stimulating effect of pituitrin is more marked on the lower part of the ureter. Because of this effect of adrenalin on the upper and middle portion of the ureter, one may infer that the administration of an adequate dose of adrenalin consti-

tutes a rational measure in the treatment of pyelitis in pregnancy. Bearing in mind that insufficiency of ureteral peristalsis should be considered as one of the main factors in the production of this condition, restoration of the efficiency of ureteric action represents an important element in its successful treatment. In addition to the establishment of improved peristaltic movements, the consolidating effect of adrenalin upon the capillaries (Auer and Meltzer, Exner, Tainter, Hanzlik) with a resulting inhibition of exudation may be of service.

There is already evidence in the literature to show that pituitary extract is of distinct value in the treatment of pyelitis in pregnancy. On the other hand, it will take considerable clinical experience to determine which of the two hormonic principles is the more effective in the treatment of the condition.

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PROLAPSE OF THE URETER THROUGH THE URETHRA

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Intravesical cystic dilatations of the roof of the intramural portion of the ureter are not uncommon. Patch (1) has recently reviewed the rather extensive literature upon this subject, reporting a case of his own, and including a comprehensive discussion of the anatomy, pathology, etiology, symptomatology and treatment. Among a variety of terms in the literature referring to this condition (including uretero-vesical cyst, intravesical ureteral cyst, intravesical ballooning of the lower end of the ureter), he has selected "ureterocele" as being more concisely descriptive. There could be no purpose in here attempting a repetition of this excellent discussion. The following case report is considered of interest because of the extreme size of the intravesical cyst, and because it was possible to so satisfactorily demonstrate the relationship of this cyst to the urethra, bladder, and ureter by the series of ureterograms here reproduced.

CASE REPORT

History. Mrs. J. E., age thirty-one, was seen May, 1926, complaining of difficult urination recurring at frequent intervals and dating back over a period of ten or twelve years. She associated this recurrent difficulty with what she described as the protrusion through the urethra of a soft mass, varying in size, but often as large as a lemon. She stated that she herself was able to cause the disappearance of this mass by pressure, sometimes easily and sometimes with difficulty. Occasionally the disappearance of this mass was spontaneous, and occasionally the assistance of a physician was necessary. In the absence of the mass, she was always comparatively free from symptoms, with the exception of a moderate degree of urinary frequency and urethral burning. Upon one occasion the diagnosis of polyp had been made, and a cure attempted by twisting off the pedicle. Other than this, her general health was

[1] By invitation.

very good. She gave no history of fever or abdominal pain or other symptoms referable to either kidney.

Examination. The patient was quite well nourished and in good physical condition. General physical examination was negative. Protruding from the urethra there was visible a lemon-sized mass, its surface bright red and granular, and its consistency soft and boggy (see fig. 1). Upon pressure this mass became small and flabby in consistency, and finally was caused to disappear through the urethra.

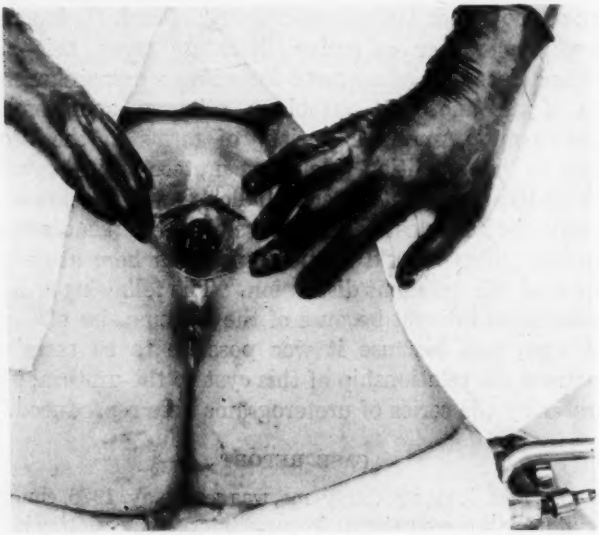

FIG. 1. PHOTOGRAPH SHOWING INTRAVESICAL URETERAL CYST PROTRUDING FROM URETHRAL ORIFICE

Cystoscopic examination showed this mass to be almost the size of a tennis ball within the bladder, occupying the greater part of the bladder lumen and apparently having its point of attachment to the right of the mid line. A clue to the diagnosis was obtained by happening to observe a small cherry-sized intravesical ballooning of the intramural portion of the *left* ureter during peristalsis, followed by a collapse of this "balloon" after the few seconds necessary for the escape of the urine from the rather small ureteral orifice (fig. 2). This observation sug-

gested the diagnosis (later confirmed) of a similar condition upon the right side, developed to an extreme degree.

Ureterogram studies. Upon a later occasion, when the prolapsed mass was again visible externally, a small puncture was made permitting the escape of several ounces of thin, purulent fluid. Through this puncture

FIG. 2. URETEROGRAM DEMONSTRATING THE SMALL INTRAVESICAL BALLOONING OF THE INTRAMURAL PORTION OF THE URETER UPON THE OTHER (LEFT) SIDE

a small rubber catheter was introduced for a distance of only 3 or 4 cm. and tightly retained by means of a purse-string suture, the patient tolerating these minor surgical manipulations without anesthesia and without pain. The "external" ureterogram shown in figure 3 was then made, after which the catheter was further introduced, passing through

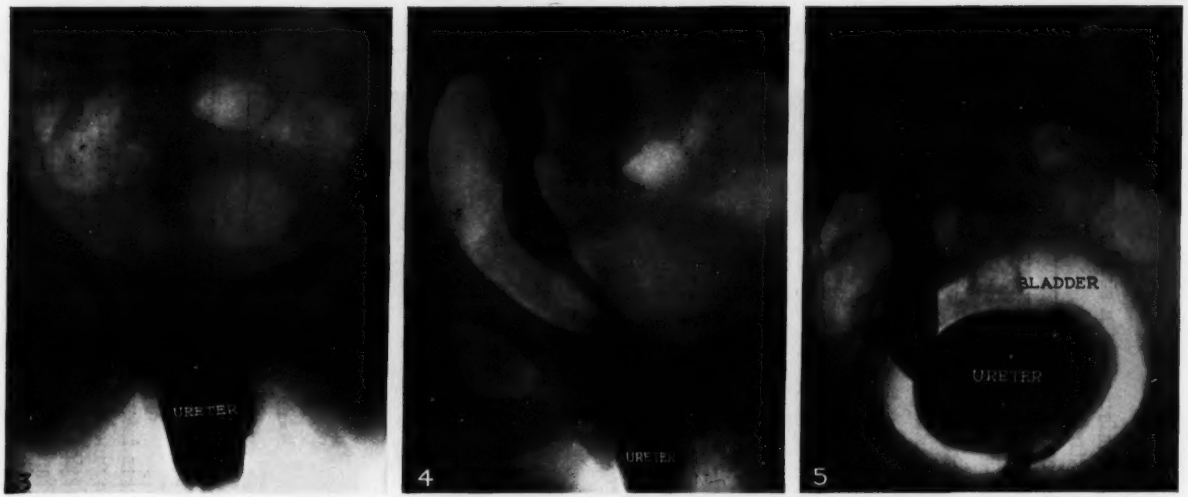

FIG. 3. "EXTERNAL" URETEROGRAM

Made by injecting sodium iodide solution through a small rubber catheter introduced through a puncture made in the protruding ureteral cyst.

FIG. 4. "DUMB-BELL" URETEROGRAM

The rubber catheter has been further introduced, passing through the urethra (note constricted portion), but at the same time being contained within the lumen of the ureter, and not communicating with the lumen of the bladder.

FIG. 5. COMBINATION URETERO-CYSTOGRAM

The protruding ureteral cyst has been pushed back into the bladder, carrying with it the small rubber catheter which is retained within the ureteral lumen by means of a purse-string suture. The large catheter has been introduced into the bladder through the urethra in the ordinary manner, and through its lumen the bladder has been moderately distended with air.

the urethra, but at the same time being contained within the lumen of the ureter and not entering the bladder itself. The second ureterogram (fig. 4) then made shows a portion of the ureter visible externally, and a narrow isthmus or constriction where the urethra was traversed, as well

FIG. 6. PYELOGRAM (RIGHT), MADE BY INJECTION INTO THE URETERAL CYST PROTRUDING EXTERNALLY

as a widely dilated upper portion. The third ureterogram (fig. 5) was then made following the reduction or replacement of the external portion of the ureter within the bladder, with the catheter contained within its lumen. This film (fig. 5) represents a combination uretero-cystogram in that sodium iodide solution was injected into the lumen of the ureter, after which air was introduced into the bladder through an additional

urethral catheter. The lumen of the bladder thus appears as a crescent-shaped area, capping and partially surrounding the ureteral cyst. As indicated in figure 5, the third ureterogram demonstrates a tremendous intravesical cystic dilatation of the ureter as well as extreme dilatation throughout the length of the ureter; also marked hydronephrosis (figure 6).

Operation. Transvesical ureterostomy with resection of the intravesical ureteral "sac." Under combined sacral and local infiltration anesthesia, the bladder was opened through an ordinary low mid-line incision, disclosing a large intravesical, elongated, collapsed pouch, about the size and shape of an ordinary Bull Durham tobacco sac, and with walls 2 or 3 mm. in thickness. This sac was amputated near its point of attachment, leaving an oval opening into the ureter, almost three centimeters in length. The hemorrhage at the edges was controlled by a continuous over-and-over catgut suture. The other ureteral orifice was then widely dilated. Closure was according to routine technique, leaving a suprapubic drainage tube in position.

Subsequent history. The convalescence was uneventful, the suprapubic fistula closing after three weeks. The patient has remained well to date, over a period of two years, having no bladder symptoms, and having had no pain or fever or other symptoms referable to either kidney.

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SCIRRHOUS CARCINOMA OF THE URETER

LATE METASTASIS FROM CARCINOMA OF THE BREAST

N. P. RATHBUN

From the Urological Service of the Brooklyn Hospital

Carcinoma of the ureter, occurring independently of carcinoma in any other part of the urinary tract is noted rather rarely, which would seem to warrant the report of another case to be added to the existing records.

The literature of primary carcinoma of the ureter was carefully reviewed by Meeker and McCarthy in 1923 at which time they were able to find a record of 33 cases and added another case of their own. In the same year, a little later, Kretschmer again reviewed the literature, analyzed the 34 cases reported and added one more. The reader is referred to these two papers for the literature up to that time.

A number of the cases reported were discovered at autopsy and in only a few was a diagnosis made preceding operation or the death of the patient. While these cases were presented as cases of primary carcinoma of the ureter, in a few, including Kretschmer's case, there was a preceding history of operation for carcinoma in some other part of the body. While the intervening period in some instances was rather long (Kretschmer's case twenty years) it would seem that the possibility of late metastases would have to be taken into consideration.

The question of course arises as to whether the small number of cases reported is a fair index to the incidence of the disease since the period covered was that of a time when urography was not so commonly employed as it is today. And, as will be noted later, it would appear that urography offers the best chance of making an early diagnosis. However, a fairly careful review of the literature of the past five years discloses only four papers dealing with the subject. This of course does not include cases of papil-

lary carcinoma complicating a similar lesion in the kidney pelvis nor cases of carcinoma which are apparently direct extension from contiguous organs.

Crance and Knickerbocker, writing in 1924, report the case of a woman of forty-two in whom the previous history was negative. For one year she had had intermittent hematuria with occasional frequency, and pain referred over the bladder. At cystoscopy the ureter catheter met an impassable obstruction at 7 cm. Manipulation of the catheter caused free bleeding which presented around the catheter. This symptom has been noted by several observers and would appear to be highly diagnostic if stone can be excluded as was done in this case. Ureterogram showed a filling defect at the site of the obstruction and dilatation above it. A diagnosis was made of carcinoma of the ureter and nephro-ureterectomy was followed by a good recovery. This would appear to be an undoubted case of primary tumor in which a fairly early and absolutely accurate pre-operative diagnosis was made. The tumor was described as epithelioma.

Mraz writing in 1924 reports the case of a woman of sixty-nine who ten years previously had had a hysterectomy for carcinoma of the corpus uteri. She remained well until five months ago when she began to complain of right lumbar pain associated with occasional frequency and intermittent hematuria. At cystoscopy the ureter catheter met an impassable obstruction on the right side at 4 cm. As in the preceding case manipulation of the catheter produced free bleeding. Stone was excluded. The radiograph showed metastases in the lumbar vertebrae. Nevertheless a nephro-ureterectomy was performed and the patient died eight months later from general metastases. The type of tumor was not noted. This would appear to be undoubtedly a case of late metastases.

Carson, writing in 1925, makes the rather striking statement that he could find only 2 cases in the literature in which carcinoma of the ureter had been clearly demonstrated as occurring by metastases through the lymphatics or blood stream. He adds three such cases of his own, one from the bladder, one from the prostate and one from the cervix uteri. He bases his conclusion

as to the method of invasion on the fact that cancer cells were demonstrated in the perivascular lymphatics of the ureter.

The same author, writing again in 1927, reports 2 cases of carcinoma of the prostate with metastases in the ureter. He calls attention to the fact that the lymphatics of the bladder, prostate and ureter communicated freely and marvels that metastases do not occur more frequently.

A report of my own case is as follows:

My patient was a male of fifty-eight, first seen in October, 1927. His previous history was entirely irrelevant, with the notable exception that in July, 1924, he had been subjected to a radical operation for scirrhous carcinoma of the left breast. He remained perfectly well until August, 1927, when he noticed blood in his urine which persisted for one day. This has recurred at intervals during the past two months occasionally lasting for one day, at other times being noted only with one act of urination. Upon careful questioning he recalls that for a few months preceding the bleeding and lasting until the present time there has been an occasional dull ache referred to the left loin. This, however, has not been a prominent symptom. His general appearance is that of a man in perfect health. The general examination is entirely negative except for a slight tenderness on deep pressure and percussion over the left costovertebral angle. There is no evidence of any local recurrence of the breast lesion.

Cystoscopy, November 1, 1927. The bladder is normal except for a moderate intravesical prostate enlargement. The ureter orifices are normal and no. 5 catheters were passed apparently to each kidney pelvis. There was some difficulty in engaging catheters because of the large prostate. Urine appeared from the right side in normal rate and rhythm. Only a few drops were obtained from the left kidney. Phenolsulphonephthalein appeared in normal time and concentration on the right while none of the dye was excreted on the left. All of the separated urines were free from abnormal elements and sterile to culture. The bladder urine showed a urea of 3.78, the right 5.67; the amount of urine from the left kidney was insufficient to test. Departing from our usual custom a simultaneous bilateral pyelogram was made using 7 cc. of a 15 per cent solution of sodium iodide on each side (fig. 1). The right pyelogram was interpreted as normal, the left showed a somewhat dilated ureter and what appeared to be a complete filling defect of the

FIG. 1. (REVERSED) ENTIRE ABSENCE OF PELVIS AND CALYCES ON LEFT
Patient breathed, so that right pyelogram is not clear, but was interpreted as normal.

FIG. 2
Arrow points to tumor

FIG. 3. KIDNEY SPLIT SHOWING MARKED HYDRONEPHROSIS
Renal cortex practically normal

renal pelvis and calices. On the basis of this interpretation a diagnosis was made of renal tumor, probably carcinoma. As subsequent developments showed, our error here was due to the fact that the growth in the ureter had obstructed its calibre sufficiently to prevent any of the pyelographic media from entering the pelvis although apparently a little urine trickled through from time to time. Radiographs of the chest and bones showed no evidence of any further metastases. Other laboratory findings were as follows:

Blood chemistry, normal
Wassermann, negative
Hemoglobin, 80 per cent
Red blood cells, 3,950,000
White blood cells, 8,200
Polys, 76 per cent
Coagulation time 7 minutes.

Operation, November 4, 1927. Left nephrectomy; upon delivering a much enlarged kidney it was noted that the pelvis was much distended and presented to the finger a consistency similar to that of a tennis ball. Even at this stage I felt that I was dealing with a tumor which filled the pelvis. The kidney and about 4 inches of the upper ureter was removed. (figs. 2 and 3).

The pathological report was as follows:

The specimen is a left kidney measuring 11 by 7.5 cm. The pelvis is greatly dilated but the kidney itself is of essentially normal shape and size. At the junction of the pelvis and ureter there is a firm nodule 1.5 cm. in diameter in the ureteral wall. This on section is opaque, grayish-white in color and compresses but does not fill the ureteral channel.

On section the pelvis is greatly dilated and the calyces are distorted in shape. The renal parenchyma shows no gross change.

Microscopic preparations from the nodule in the ureteral wall show the lumen patent but compressed by the nodule. The ureteral epithelium is absent on the side of the ureter nearest the nodule but present on the opposite side of the lumen. In the central part of the fibrous nodule there are small nests of an alveolar tumor of epithelial type. The epithelial cells forming these alveoli bear no resemblance to the cells of either renal or ureteral tumors usually seen. The fibrous reaction is clearly due to the tumor cells (figs. 4 and 5).

Comparison of the microscopic preparations of the tumor nodule in the ureteral wall with those of the mammary tumor removed from the

same patient at an earlier date shows that the tumor cells are of the same type and they form similar alveolar structures. The reaction about the tumor cells is the same in both (fig. 6).

Diagnosis. Hydronephrosis. Mammary carcinoma metastic in ureteral wall.

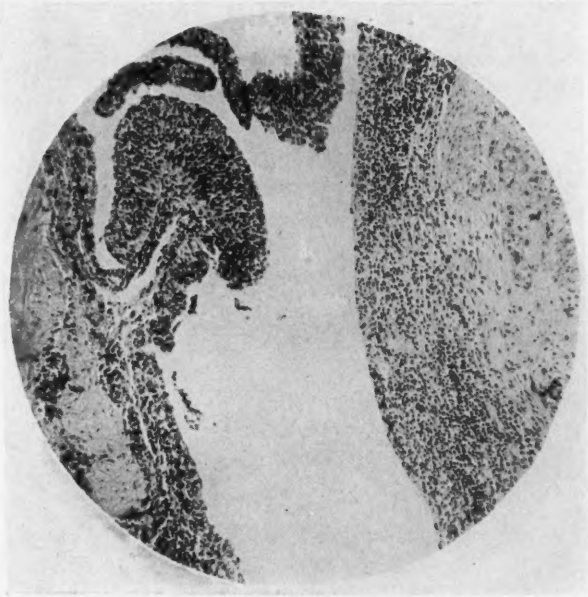

FIG. 4. SECTION OF URETER-MUCOUS MEMBRANE PRESENT ON LEFT SIDE, TUMOR NODULE IN WALL BULGING INTO LUMEN ON THE OTHER

The patient made a good recovery and at present, five months after operation, seems in good health. It is, of course, too early to venture anything other than a very dubious prognosis. It is probably reasonable to assume that there are other unrecognized metastases which will assert themselves later.

It would appear that with modern methods of examination a diagnosis should be made more frequently than has been done in

the past. Of course there are few if any subjective symptoms of value. In the recorded cases the outstanding symptoms seem to have been intermittent hematuria plus the symptoms of the associated hydronephrosis. Objectively there is one finding which would appear to be of great value particularly when the lesion is in the lower segment of ureter and that is the presence of

FIG. 5. TUMOR NODULE IN URETERAL WALL. NESTS OF CRUDE ALVEOLI SURROUNDED BY DENSE FIBROUS TISSUE

active bleeding provoked by the tip of a catheter at the point of obstruction, provided stone can be excluded. In cases where it is possible to make a ureterogram (and this should be repeated, if unsuccessful at the first attempt), the filling defect and the dilatation above should make a diagnosis in rather a high proportion of the cases. This did not apply in my own case for the reason that the tumor was situated so near to the kidney pelvis.

However in the majority of the cases reported the lesion has been noted in the lower segment.

The treatment employed in most of the operated cases has been nephro-ureterectomy or nephrectomy followed later by ureterectomy. One line of attack which would of course occur to all of us as a possibility would be resection and anastomosis of the

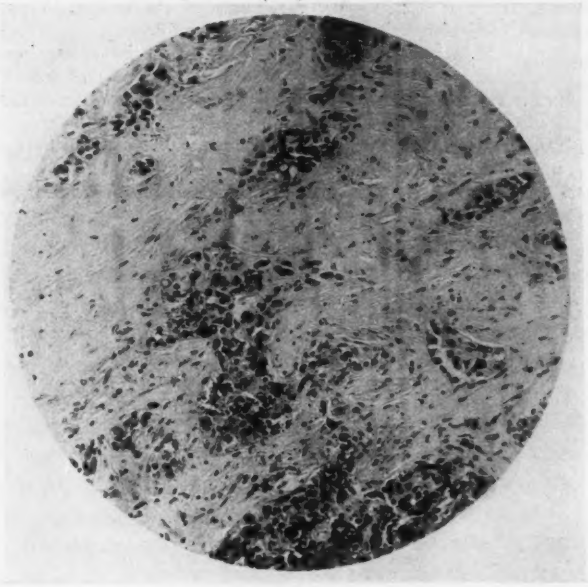

FIG. 6. SECTION FROM ORIGINAL MAMMARY TUMOR SHOWING SIMILARITY TO TUMOR APPEARING LATER IN URETER

ureter. So far as I know this has been attempted only once. Quinby performed this operation on one of his cases but was obliged to do a nephrectomy ten days later. I have no doubt that with further refinement of technique and in a properly selected case such a procedure might be successfully accomplished.

Another mode of attack which might, in the presence of a

healthy kidney, merit consideration would be ureterectomy plus a lumbar nephrotomy or pyelotomy. Of course this would be the only possible method of surgical attack in the event of the remaining kidney being absent or insufficient to sustain life.

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CONCERNING THE DYNAMICS OF THE URETER

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The clinical methods in use at present by which the diagnosis of lesions of the ureter is made have inherent in themselves a percentage of error always considerable. Though absolute accuracy of any method is beyond attainment, effort is always to be made to reduce so far as possible this percentage of error. To this end it is the writer's feeling that consideration of the physiological data concerning the dynamics of the ureter—the factors and forces relating to its motion—is important; for among clinicians the tendency is greater to emphasize pathological factors than physiological ones; or even—and this is a much more important error—to confuse appearances due to normal factors with those assumed to be due to abnormal ones.

The ureter being made up of plain muscle for the most part, it is interesting for a moment to consider what is known today of the physiology of such tissue. A recent summary of the subject has been reported by Evans. Study of the individual fiber shows that its reactions, especially as concern stretching and contraction, are in many ways similar to striated muscle, but performed always at a much slower rate. Plain muscle is a very extensible tissue, but this extensibility varies according to the conditions under which the fiber finds itself. When a weight is applied to it a certain amount of extension occurs almost at once, to be followed by a slower and longer lasting after-extension. This is due to the high viscosity of the cytoplasm. This resistance to extension is always normally present and is called its tonus.

It is of more especial interest to the urologist to consider the various stimuli to which the plain muscle fiber will react by contracting, and the list of such is found to be very extensive. Mechanical, thermal, chemical, electric stimuli, or in the case of

the eye, even light, are able to cause contraction. As Evans says, "Almost any alteration, provided it be a sudden one, in the chemical or physical conditions can excite plain muscle."

In regard to the causation of peristalsis which is so characteristic of the ureter, the most recent evidence seems to show that it is of myogenic origin and related to variations in hydrogen ionization and subsequent osmotic changes in the cell with relation to its surrounding fluids, rather than to any specific nervous impulses. Unlike the intestine the ureter is not surrounded by a smooth, serous surface such as peritoneum, but by a loose connective tissue in which there is a considerable amount of fat. Peristalsis of the ureter, therefore, is found to be a more sluggish and less forceful wave than is peristalsis of the intestine. It is, therefore, of the greatest importance for the integrity of ureteral peristalsis that the density of the surrounding tissue about the ureter be not increased by products of inflammation or edema.

When subjected to a load over any considerable period of time, the plain muscle fiber eventually relaxes, losing its tonus, and a condition of atony ensues. In the ureter such a condition is frequently seen clinically, as illustrated by dilatation and increase in total length of the tube.

The peristaltic wave of the ureter has been studied by Boeminghaus, who finds that it normally starts in the renal pelvis and is propagated downward at a rate of from 1 to 3 cm. per second. According to the degree of activity at the time of observation, these waves extend all the way to the bladder, or some of them become interrupted and cease before reaching so far. Studying the ureter by the radiograph he found that the fluid in the ureter under conditions of moderate filling was propagated downward toward the bladder in a series of segments quite similar to those seen in the intestine. Extreme overdistension of the ureter by increase in the quantity of fluid inhibited the peristalsis entirely, and converted the flow into a continuous one, such as is seen in any inert tube.

The ejection of the fluid into the bladder takes definite forms and these have been studied in a large series of cases in man by Pflaumer. After the injection of indigocarmin the form of

efflux from the ureter into the bladder may be of five sorts. Two types of efflux are seen under normal conditions, and three under pathological conditions.

That there is a definite relation between the tonus of the bladder and the activity of the ureter together with its ureterovesical opening, will be remembered as illustrated by the reports of Graves already before this Society. Such upward reflux from the bladder into the ureter as he describes is still further evidence of the capricious character of this tube.

Our present clinical methods of evaluating the function of the ureter fall into four groups: (1) X-ray examination of the urinary tract which has been filled by a pyelographic medium. (2) Ureteroscopy or chromocystoscopy. (3) Pyeloscopy. (4) Ureteral catheterization with the passage of bulbs.

If we consider the details of the performance of such procedures in regard to their possible physiological effect as stimulants of plain muscle contraction we will immediately see that there is ample room for variation in results. Though the pyelogram may be of the utmost importance in outlining pathological conditions in the pelvis and ureter, we must not overlook the fact that unless the substance used is isotonic with the urine and also in just the proper amount so that overdistension be not produced, error may creep in. The method of chromocystoscopy is open to very few sources of error—the only abnormal stimulant being the presence of the cystoscope in the bladder. But such observations must necessarily confine themselves to the method of appearance of urine in the bladder and in no way afford detailed evidence of structural changes in the upper tracts. The third method, that of pyeloscopy, is open to a good many of the same limitations as is the pyelogram. It does, however, afford opportunity to watch the ability of the renal pelvis and ureter to empty after having been filled with an opaque medium, and in many instances gives information which is reliable and of value. The fourth method of examination by the passage of bulbs up the ureter must give, from its very nature, results highly fallacious in many instances; for by the passage of bulbs there is set up a mechanical stimulant of a very direct sort, the response to which is un-

doubtedly contraction or spasm of the ureter. If one bases a diagnosis of a pathological stricture on such evidence alone, it is to be expected that such evidence will be fallacious in many instances.

My aim in bringing these considerations before you is in the nature of a plea that as urologists having to deal frequently with the ureter we may keep a habit of mind appreciative of the complicated conditions underlying its activity—that is its dynamics—and be always critical of the trustworthiness or lack thereof, of our various methods of observation. I think we will thus much less often consider every tortuosity of the ureter to be a "kink;" every narrowing below a spindle shadow outline of the ureter, a "stricture;" and every pelvis holding somewhat more than the expected amount of cubic centimeters, a "hydronephrosis."

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DISCUSSION

Dr. GUY HUNNER (Baltimore, Md.): I appreciate very much indeed this privilege of meeting with you again and having a word to say about these extremely interesting papers. I am sorry I can't take up each one of them individually. As I entered the door my old friend, Arthur Chute, said, "Well, here comes Hunner. Now we'll have a fight."

I said, "No, Arthur, I am lying down now with the lambs and there is no more fight in me." But along comes friend Braasch and arouses my belligerency.

It is quite evident that I have got to change my nomenclature or my methods or I have got to go home and ship back to their homes a lot of patients that I have promised to relieve of various complaints. Many of these patients have been sent to me by other patients who imagined they had had relief from similar complaints by these methods. If my work were really a species of psychic influence on the patients, as some folks have very profoundly believed, I think I really ought to join the psychoneurologists, for I believe that I get perhaps a larger percentage of cures from these "imaginary" complaints than many of the psychoneurologists do.

Seriously, I agree with one of the last remarks of Dr. Braasch, and that is that we have material here for study and controversy for many years to come. I came over largely to hear Dr. Hofbauer's paper and he asked me if I would discuss it. I am sorry that I am not equipped to discuss the latter part of his paper referring to treatment of ureteral conditions by these various drugs. I think, however, after observing his work in this line that he is on the right track and his methods deserve further research.

We can not well get around his conclusions on the anatomical features of the ureter during pregnancy. I think we are all deeply indebted to him. I do not know of anyone who is as thoroughly

qualified to make this study, because of his previous work in gynecological pathology in studying the changes in the genital tract during pregnancy.

As you all know, there have been many papers quite recently on ureteral studies during pregnancy showing evidences of a high incidence of stasis and dilatation in the upper tract during pregnancy. These studies have been made largely, as has been intimated, by the x-ray methods of study. Dr. Hofbauer's work, of course, puts these changes in the upper tract on a firm, anatomical basis. I think the first thing that impresses one is the biological question; If all women have to stand up against all these changes in the upper urinary tract during pregnancy, how does it happen that there are any women left to propagate the race? I suppose that there must be a large element of conservation behind all of these changes, this muscle hypertrophy, and the hyperplasia of the fibrous tissues, the edema and the encircling pressure of the hypertrophied sheath, to say nothing of the possible pressures and angulations due to the changes in the genital tract. Certainly there is here an array of factors that seem to be of a destructive character as far as the urinary tract is concerned. But there must be some constructive, some preservative element in this. It seems to me possible that this great hypertrophy in the lower end of the ureter may serve to provide a suction action to help out the upper tract under its stress and back pressure. He has shown us that the upper tract does have some hypertrophy, undoubtedly a protective measure to overcome the stasis of urine that apparently is physiological at this time.

The chief question, of course, is that relating to pyelitis of pregnancy. We know that only a comparatively small number of women who are pregnant get a pyelitis of pregnancy. In other words, there is some mechanism that protects and carries the pregnant women through normally. We know that some who do get a pyelitis of pregnancy clear up within ten days as does the ordinary case of pyelitis, if put at rest and given plenty of fluids. There is the other class, however, that persists with the pyelitis of pregnancy or clears up temporarily and has another attack in the pregnancy or in the puerperium. I usually see only these chronic cases associated with pregnancy or the puerperium.

In my experience they usually have some form of chronic stasis which I have interpreted as being due to an organic condition in the ureter and which I have called ureteral stricture. The mere dilatation of this area somehow or other seems to have the desired result of restoring drainage and clearing up the infection.

Dr. NATHANIEL G. ALCOCK (Iowa City): I would like to speak for just a moment on Dr. Hofbauer's paper.

It seems to me that this is probably the most important contribution that I have ever heard on the subject of the dilatation of the ureter in pregnancy. Pressure has never seemed to me to completely explain it. In discussing this with an obstetrician some years ago, he suggested we would never be able to completely solve this until we could find something in the toxemia of pregnancy that would explain the apparent partial paralysis of the smooth muscle of the bowel. Explaining the paralysis of the smooth muscle of the bowel would account for the constipation that these patients have and would also explain the ureteral dilatation on the same basis. The thing that stood in the way of that was the fact that the ureter so frequently is dilated only to a short distance below the brim of the pelvis. In fact, that was the big argument in favor of the pressure theory.

Doctor Hofbauer's contribution seems to me to elucidate the whole problem. He certainly has given us some biological explanation for the dilatation, and the hypertrophy of the muscle in the lower ureter would account for the lack of dilatation in that segment. It, therefore, seems to me this is a very important contribution.

Dr. ARTHUR L. CHUTE (Boston): May I just express my appreciation of the wonderfully good work that has been brought before us. I regret that I am quite unable to discuss it intelligently. We are to be congratulated on the opportunity to hear such good papers, and I am sure we are very thankful to these men who have come in and given us this food for thought, which I am sure, when we have assimilated and digested it, we shall find of great help in our every day work. I want to express my thanks.

Dr. GEORGE R. LIVERMORE (Memphis): I was just wondering, following the Doctor's statement on the bile salts increasing in pregnancy and the relaxation of the ureter which it causes, if perhaps that would be a stimulus for some of us to do some experimentation along the line of the relief of the spasm that so often results in passing catheters up the ureters. Perhaps if we could get some bile salt preparation which we could use as an injection at this time to cause relaxation, it would be a great help to us in such cases.

Dr. RICHARD F. O'NEIL (Boston): I should like to make brief mention of a case of Dr. Chute's which came into my hands while he was away.

This was a woman in the sixties who was in a private hospital in Boston, for observation, as I remember it, for severe arthritis and upper right quadrant pain. She had been cystoscoped on one or two occasions and it had been demonstrated by means of ureterography and ureter catheterization that there was an absolute obstruction about half way up.

When I first saw her she was running a temperature and having pain in the right loin and right upper quadrant. She also had a severe arthritic process in the lower back. She was under the charge of a medical man and an orthopaedist. Their opinion was, as the only definite pathology that could be demonstrated was an apparently shut-off kidney, that that was probably the cause of her fever and might be the focus for her arthritic process. She was also seen in consultation by a general surgeon who was of the same opinion.

Although the palpation and type of pain were not particularly suggestive of a kidney lesion, it seemed a fair inference that she had an infected shut-off kidney, and so I performed a nephrectomy. I found, on exposing the ureter, that it was dark in color and was filled with a dark, coffee-colored fluid under considerable tension. She was rather ill and I did as quick an operation as I could without exploring the ureter any further. She went along nicely for a few days. Her temperature dropped and she seemed to be improving.

Dr. Chute returned and I dropped out of the case. Her temperature rose again. She ran along for several weeks, getting worse. She finally died and the autopsy showed a primary carcinoma of the ureter with secondary metastatic process in the liver and I believe in the lung. Of course, her symptoms were easily explained by these findings. There was no infection of the kidney but there was sufficient tension from back pressure to give her pain in the kidney.

Dr. WILLIAM F. BRAASCH (closing): I am sorry that this contribution of Dr. Frater and myself should arouse the old controversy. Our only hope was that it might stimulate all of us to further study of the pathology of the ureter and I sincerely hope it will do so. No matter what opinion we may have on the very important subject of stricture of the ureter, unless we can base our conclusions upon pathology, they are not really worth very much. Therefore, I hope that our knowledge of the pathology of the ureter, particularly as applied to stricture, will be intensively studied in the next few years.

There is one feature of the pathology of the ureter which has escaped our attention, and that is the so-called atonic dilatation. I have long felt that the importance of recognizing this condition is very great. I formerly alluded to it as inflammatory dilatation, but we can have atonic dilatation resulting from a number of other causes than inflammation, as Dr. Hofbauer has suggested.

In closing I will say that most of the work which I have reported this morning was done by Dr. Frater, a Fellow in Urology at the Mayo Foundation, and that I merely acted as a referee on the side lines, and a very interested spectator.

Dr. ISFRED HOFBAUER (closing): I desire to express my deep appreciation of the great interest which my paper has been accorded. I could not go into details of the histology of the whole urinary tract during pregnancy.

May I call your attention to one more point, namely, that similar hypertrophic changes occur in the trigonium of the bladder —both in musculature and connective tissue, as described in the

wall of the ureter. Hypertrophy of the trigonium during pregnancy, on the other hand, represents in itself, some obstruction to the urinary flow, and might well account for the well-known presence of some residual urine in the bladder of normal pregnant women.

The effect of bile acids and their salts on smooth muscle is comparable to the action of narcotics.

THE UROLOGICAL COMPLICATIONS OF IMPERFORATE ANUS

J. DELLINGER BARNEY

Boston, Massachusetts

The case to be reported and a review of others from different sources indicates that imperforate anus in the male is so frequently complicated by recto-urinary fistula as to make it a subject of interest to the urologist.

M.D., an Italian boy of seven years, was referred to me in May, 1922, by Dr. O. D. Phelps of Worcester.

The boy was born with what was said to be an imperforate anus. This was operated upon shortly after birth by another physician. No details of the operation can be obtained. Following the operation and up to the time I saw him the boy had had no control whatever of his feces and passed urine through the anus from time to time. It was always taken for granted that the urinary fistula was the result of the operation for imperforate anus and not due to a congenital abnormality. Except for this defect the boy was healthy and normal. There was no history of other congenital malformations in the family.

Dr. Phelps, in his examination of the child, found that bougies up to no. 13 French would pass easily to the bladder but that they would sometimes pass out of the urethra into the rectum, where they could be felt and seen. Urine obtained by catheter was perfectly normal. Because of the discomfort occasioned by his abnormal condition and also because it was utterly impossible for him to go to school or to associate with others, operation was advised and accepted.

The patient was admitted to the hospital on May 15, 1922. An attempt was made to cystoscope him on May 18 in the belief that something might be seen which would throw further light on the condition. A no. 15 cystoscope could not be passed, owing, perhaps, to the direction of the urethral canal. Bougies up to no. 15 French passed easily but it was difficult to keep them from entering the rectum, in which they could be easily seen and palpated through the large and patulous anus.

There was apparently no anal sphincter, an observation which was confirmed later at operation. The fistula was, apparently, in the bulbous or prostatic portion of the urethra. A cystogram showed nothing abnormal. The urine before operation was entirely negative.

Operation was performed on May 22, 1922, under ether anesthesia with the patient in the exaggerated lithotomy position. A median racquet-shaped incision was made, including the orifice of the anus. This anal orifice was considerably posterior to that of a normal anus, was much larger, patulous and entirely without evidence of a muscular sphincter. The rectum was freed up all around and in doing so the fistulous connection between it and the bulbous urethra was encountered, this identification being facilitated by the previous passage of a bougie through the urethra. The fistulous tract was about 1 cm. long and was lined with mucosa. It was freed up to the urethra and excised. The urethral opening was then closed with a double row of chronic catgut sutures over a bougie as a guide. The rectum was then still further freed and drawn down, the lower 2 cm. containing the fistulous opening being amputated. A longitudinal row of catgut sutures was then placed posteriorly for a distance of about 1.5 cm. upward from the end of the rectum, in the hope of decreasing the size of the future anal opening. The gut was then sutured in several places to the subcutaneous tissues with a few stitches placed proximal to the cut end, and the latter was sutured to the skin with catgut. In so doing the opening of the gut was brought forward to the anterior end of the skin incision as far as possible so as to more nearly approach the position of a normally placed anus. During the dissection a careful search for anal sphincter muscles was made but none were found. The skin incision was then closed around 2 small rubber wicks, one anterior, the other posterior to the rectum.

A suprapubic cystotomy was then done in the usual manner, the wound being closed in layers around a self-retaining catheter.

Convalescence was interrupted only by the fact that up to the thirteenth day the perineal wound was more or less constantly soiled with feces, owing to incontinence. There was, however, perfect control of the urine after the closure of the suprapubic sinus on the sixteenth day. The patient was discharged on the twenty-third day.

One year later Dr. Phelps reported as follows: "The patient has been able to attend school the entire year and has not been sent home once on account of soiling himself, for which condition he sought relief. I feel that the operation was as successful as any operation for this condition

could be; while it is not 100 per cent it is near enough so that we are all much pleased."

The patient was seen by me on March 1, 1928. He is a healthy, well-developed, apparently normal boy of about fourteen years, large for

FIG. 1

his age. He attends school regularly. He has no urinary symptoms and no incontinence whatever of either urine or feces. The bowels move normally once or twice daily with ample warning beforehand.

Examination showed an anal opening about 1½ inches long by 1 inch

wide, situated a little posterior to the normal position. The orifice was patent and flaccid, there being no suggestion of a sphincter or of any muscular control. The anterior rectal wall lay against the anal opening, giving the suggestion that in so doing it acts as a sort of valve (figs. 1 and 2). On coughing there was no escape of gas or feces and no prolapse of the rectal mucosa. The voided urine was perfectly clear and

FIG. 2

was normal chemically and microscopically. A no. 16 soft rubber catheter passed easily to the bladder and there was no residual urine.

As to the frequency of imperforate anus (a term which covers several varieties of this malformation) Quinland (1) says that it has occurred once in 10,000 births at the Boston Lying-in Hospital, and twice in a similar number at the Chicago Lying-in Hospital. At the New York Lying-in Hospital there were 28

cases among 50,000 births but this included atresia as well as imperforation.

Curling (5) in 1876 and Cripps (7) in 1882, each collected 100 cases. After reading their papers one is led to infer that this number of cases was assembled with some difficulty. Quinland (1) collected 27 cases, of which 4 were from the surgical service of the Children's Hospital, Boston, and 23 from the Warren Museum at the Harvard Medical School, where some of them had reposed for nearly one hundred years. Fitchet (2) found 31 cases in the records of the Massachusetts General Hospital between 1873 and 1926. Keith (3) was able to find and study only 114 specimens among all the medical schools and medical museums of London. More recently it has been reported to me through the kindness of Dr. L. R. Jacobus (4) that since 1914 there are records of 34 cases at the Children's Hospital in Boston (this number doubtless includes the 4 already reported by Quinland in 1922).

From these investigations it would appear that imperforate anus is not of common occurrence. All writers have found that imperforate anus is found in the male more often than in the female. Curling's (5) figures showed 68 per cent in the male, while those of other authors were almost as large.

From the literature and from hospital records I have collected 375 cases in which there is a definite statement that the rectum opened into some portion of the urinary tract in 94 or 25.33 per cent. It is also interesting to note that all of these recto-urinary fistulae occurred in boys. Six cases in females (museum specimens) are briefly mentioned by Keith (3) wherein the vulva and clitoris are prolonged to form a urethra, the rectum opening in the floor of the urethra immediately below the orifice of the vagina (fig. 6[1]). The abnormal rectal opening in this group is exactly similar to that seen below the veru in the male.

Keith (3) has shown in a diagram (fig. 4) that among the 54 human male cases studied by him the rectum opened into some portion of the urethra in 33 and ended as a blind cord at or above

[1] This illustration, as well as figures 3, 4 and 5 were taken from Keith's admirable paper cited in my references.

the base of the prostate in 7. He says that where the rectum ended at the lower end of the veru it lay beyond the openings of

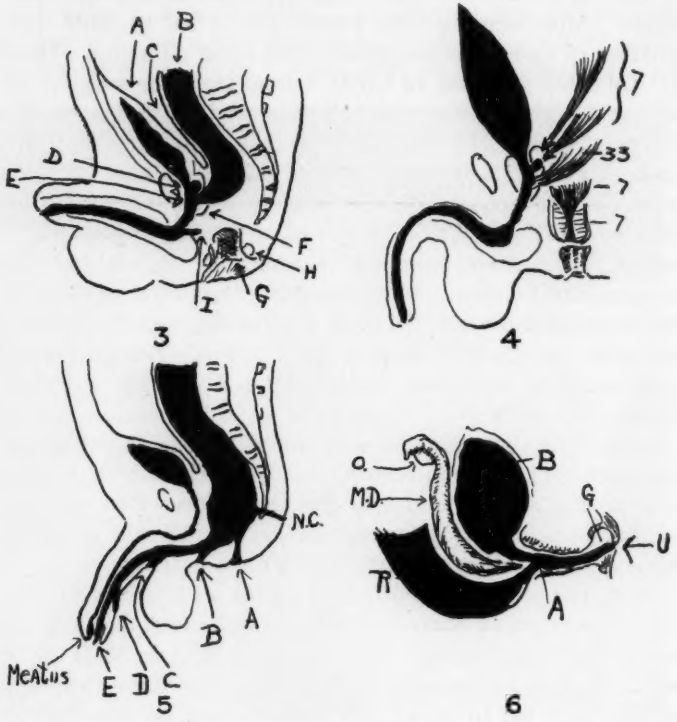

FIG. 3. Section of pelvis of male child showing rectum opening into prostatic urethra. *A*, bladder; *B*, rectum; *C*, recto-vesicle pouch; *D*, uterus masculinus; *E*, intra-cloacal anus; *F*, prostate; *G*, site of normal anus; *H*, anal sphincters; *G*, Cowper's gland.

FIG. 4. Illustrating the various degrees of imperfection of rectum in the male. The rectum is shaded. The numbers indicate the number of cases in Keith's collection.

FIG. 5. Showing the normal and abnormal sites of anus. *A*, normal position; *B*, perineal orifice; *C*, scrotal orifice; *D*, subpenile; *E*, intra-preputial; *N.C.*, neuroenteric canal.

FIG. 6. Female with rectum opening into urethra. *O*, ovary; *M.D.*, mullerian duct; *R*, rectum; *B*, bladder; *G*, glans clitoris; *U*, urethral orifice; *A*, cloacal anus.

the uterus masculinus and the ejaculatory ducts. It was always valvular in form and in all the specimens the orifice was provided

with a definite sphincter. In 4 cases the orifice was 2 to 3 mm. in diameter, in 5 from 1 to 2 mm. and in 6 was merely large enough to take a bristle. In 21 cases where the exact position of the orifice was seen it occurred at the lower end of the veru in 17, at the apex of the prostate in 1, at the side of the veru in 1, at the internal urinary meatus in 1, and in the trigonum in 1.

Quinland's (1) series of 27 cases included 7 males with recto-urinary fistulae. In 3 the rectum entered the prostatic urethra, in 3 others it joined the membranous urethra, and in 1 it opened directly into the bladder.

Bevan (6) has reported a case in which the bladder and rectum formed one large cavity.

Cripps' (7) 100 cases included 13 males, of which 10 died and came to autopsy. In 6 the fistula was between the prostate and the rectum; in 4 the rectum communicated directly with the bladder. In one of these it joined the bladder at its dome; in another the fistula was almost microscopic and was situated at the base of the bladder; in a third case the rectum opened close to the urethral orifice and in the fourth case the bowel ended with the sigmoid flexure and this communicated with the upper part of the bladder. Among the cases at the Children's Hospital reported to me by Dr. Jacobus (4), there were 2 recto-urethral and 6 recto-vesical fistulae.

Keith (3) speaks also of certain cases (apparently very rare) wherein not only the perineal orifice of the cloaca is carried forward on the outgrowing penis but the rectal orifice is transplanted forward with it. The rectum under these conditions may open on the frenum of the prepuce, on the under surface of the penis, or on the scrotal raphé (fig. 5). In domestic animals there were found 2 males where the rectum ended in the bulbous portion of the urethra.

While this review includes a considerable number of cases it does not by any means pretend to include all those reported in the literature. It is sufficient, however, to show what one is likely to find in a case of imperforate anus, occurring in a male child.

Any attempt to explain the causes of these unfortunate mal-

formations would be futile. In the first place, the development of the normal cloaca and its ultimate separation into intestinal, urinary and genital compartments is still under discussion. If the normal is still incompletely understood it is not reasonable to suppose that any sound theory can be advanced to explain the various anomalies. In reviewing the literature I find that such is the case.

Jones (8) says that in the process by which one cavity becomes subdivided into two or more secondary cavities, a change which appears to be due to the active growth of a septum or septa may in reality be due to an active growth of the cavities themselves and to a passive relative diminution of the openings that connect them. It is probable, Jones says, that in various organs this active growth of cavities and passive growth of septa is the more probable explanation of the process by which the fully developed condition is arrived at. His explanation of the development of the hind end of the body including cloaca, vagina, rectum, urethra varies from that ordinarily given. He says we must hold to the idea that these canals are new down growths and not smaller subdivisions of wide open cavities. A stage of imperforation persists in the development of the posterior vesical orifices and in all these orifices the imperforation stage may persist as an abnormality.

Keith (3) who has studied the question with great thoroughness disagrees with Jones. He thinks the key to these abnormalities is to be found in a study of the comparative anatomy and physiology of the cloaca, rectum and urogenital passages. Much of the obscurity of the hind end of the body results from an imperfect knowledge of what the cloaca is. He thinks that the solution of many of these malformations is to be discovered by experiments on developing animals. He cites the investigation of Mall of 163 malformed human embryos, in the chorion of every one of which there was found evidences of uterine inflammation. Keith (3) thinks that the proper interpretation of Keibel's models (fig. 7) is not that the cloaca is being divided but that the rectum is gradually migrating from the amphibian to the mammalian position and may undergo arrest at any stage of its progress during the development of the embryo. One must remember

also that the migration of the rectum is connected with a sexual problem, namely, the evolution of the penis and a transformation of the cloaca to form the genital passage. It is, therefore, possible that the cause of arrest may be found in a primary defect of the sexual glands. In females where the rectum opens into the navicular fossa of the vulval cleft it corresponds to cases in the male where it opens into the floor of the urethra just below the veru.

One is apparently at liberty to accept the theory not only of normal but of abnormal development which most appeals to him. I feel, however, that the views of Keith (3) already referred to

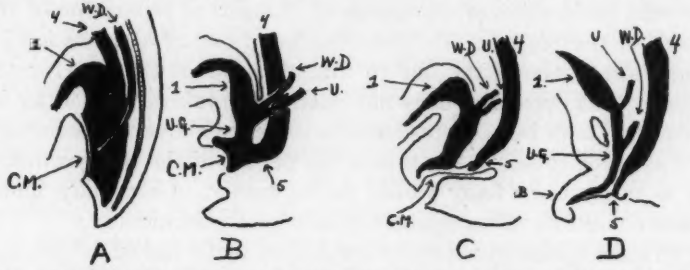

FIG. 7. SHOWING THE MANNER IN WHICH THE RECTUM BECOMES SEPARATED FROM THE UROGENITAL SINUS (ENDODERMAL CLOACA) DURING DEVELOPMENT OF THE HUMAN EMBRYO.

(A) from human embryo 4 mm. long (about 20 days); after Keibel. (B) from human embryo 11 mm. long (about 35 days); after Keibel. (C and D) later stages of development; *1*, bladder; *2*, Wolffian duct (ureter and vas); *3*, endodermal cloaca; *4*, rectum; *5*, anus; *C.M.*, cloacal membrane; *U.G.*, urogenital sinus; *A*, mesoblast at junction of rectum and endodermal cloaca; *B*, penis; *XX*, the limits of the perineal depression (ectodermal cloaca). Taken from Keith's article.

in a very brief way, explain more than any others not only the normal but the abnormal changes. The last word has not been said nor will it be till countless patient investigators have each added their bit of evidence.

According to Keith (3) the development of the anal depression is an uncertain index, not only of the degree to which the rectum is developed but also as to the proximity of its termination to the surface of the body.

Among the males where the rectum entered the urethra there were 7 with the proctodaeum (anal depression) well marked, 3 wherein it was partly developed and an uncertain number where

it was absent. In 7 males where the rectum ended blindly at or above the prostate the proctodaeum was present in 4, absent in 3. As the external and internal sphincters are developed in connection with the perineum and not with the bowel, if a well developed anal depression is present there is always a good prospect that the anal orifice established by operation will be provided with adequate sphincters.

All writers seem to agree that the use of a trocar for even the temporary relief of imperforate anus is a dangerous procedure. Keith (3) describes 11 specimens from cases so treated which showed perforation of the pouch of Douglas or separation of the coats of the rectum. On the other hand the usual operation for imperforate anus may fail to find the end of the gut for the reason that even if it does not open into urethra or bladder its blind end may be at a considerable distance above the perineum. To attempt to search for this in the depths of the tiny perineum of a newly born baby would be foolhardy. Colostomy under these conditions offers the best chance for the moment.

In male babies with a recto-urethral or recto-vesical fistula, and in female babies with a recto-vaginal fistula the necessity for immediate post-natal operation is not so urgent. In these cases meconium and even feces may sometimes be passed for a long period of time in sufficient amount to maintain a state of health. Apparently, however, especially in the recto-urinary fistulae in males, inspissation of meconium or feces is likely to occlude the fistula or accumulate in the bladder and this soon leads to a fatal termination. Death, apparently, is the result not of urinary infection but of intestinal obstruction.

While Thom (1) seems to be responsible for the statement that the first perineal operation for imperforate anus was performed eighteen hundred years ago by one Egineta, there can be no doubt that some sort of frantic effort must have been made to relieve the first victim of this unfortunate condition who made his appearance on this earth. Bell of England, in 1787 is credited with the first rational dissection of the perineum with a search for the rectal ampulla and it is said that the first successful perineal operation in this country was performed by Campbell in

1790. I have found, however, no account of attempts to deal with urinary fistulae coexisting with imperforate anus. That there have been many fatalities following operation there is no doubt. The case which forms the basis of this communication seems to be unique so far as treatment and a satisfactory result is concerned. For this reason and because it demonstrates the efficacy of the Young-Stone operation (even though somewhat modified) it seems worth recording.

While I have only this solitary personal experience on which to base an opinion it, and the observations of other writers makes me feel that in a similar case the attempt to bring about a cure should be divided into two stages. First, of course, must come the relief of the rectal imperforation. Perineal operation done within a day or two after birth will apparently find and open the rectal ampulla in most cases without any great chance of a fatal result. Whether or no there is a urinary fistula, if the ampulla is not readily found, it is wiser to do a colostomy than to attempt a dissection of the depths of the pelvis. At a later time, perhaps, after some years, a perineal operation could be safely and successfully undertaken and the colostomy closed. The urinary fistula might be closed at this time or perhaps it would be wiser to leave this as a third stage of the operation to be done when conditions were even more favorable. As the fistulous connection between the rectum and the urinary tract seems to be provided, according to Keith, with a well developed sphincter, the likelihood of infection of the urinary tract by fecal contamination is apparently small.

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TREATMENT OF COMPLETE RUPTURE OF THE POSTERIOR URETHRA, RECENT OR ACCIDENT, BY ANASTOMOSIS

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I wish to report today nine cases of fracture of the pelvis which have been complicated by rupture of the urethra. In all these cases the fracture resulted from a crushing blow, and the urethral injury in all of these cases is sharply differentiated from that which is caused by the body following astride some object. In the latter case the rupture is almost external to the triangular ligament and in the bulbous urethra. In the nine cases which I have here reported the rupture was behind or at the triangular ligament. In some cases the prostate was torn off completely from the urethra, and was found at operation much higher than the normal position. In all but one of these cases the patient received preliminary treatment elsewhere, and came here months or years later with complications which were varied in character and severity. In most cases where the rupture of the urethra had been complete, there was entire absence of erections. In the other cases the impairment of erections and sexual powers depended on the extent of the lesion. In one interesting case one corpus cavernosum failed to become erect, owing to the fact that the crus on that side was caught in extensive bony exostosis. The symptomatology was varied, owing to the character of the lesion, and the severe complications which accompanied many of the cases. The operative treatment was varied very greatly, and presents a wide range of operative manoeuvres which are necessary to restore these cases to a normal condition. In the first case, in which the prostate was torn completely off from the membranous urethra we saw the patient early, and by anastomo-

sis were able to give the patient a normal urethra without subsequent development of stricture. This case, we feel, may be taken as an example of the appropriate treatment for such cases when seen by the surgeon shortly after the accident. The other cases in which such immediate plastic repair was not carried out were followed by complications which lasted for years, and required difficult operative procedures for their cure. These procedures were so multiple and extensive that the reader is referred to each case for a discussion of the individual operative indications.

Case 1. Fracture of the pelvis; complete transverse rupture of the urethra at junction with prostate; immediate anastomosis; perfect result except complete loss of erections.

Man, aged twenty-three years, married. The patient was seen at his home. About twelve hours before he had been caught between two freight cars which he was in the act of coupling, and had sustained a severe injury. He was immediately taken to his home. He passed a moderate amount of blood from the urethra. He had been unable to void urine, suffered severe pain, had a constantly increasing swelling of the abdomen, and was greatly shocked. On examination he was found to be pale, with a very rapid pulse. The abdomen was greatly distended, and on palpation a round mass, which reached above the umbilicus and extended from there down into the pelvis, was found which felt almost like a gravid uterus at term. There was a moderate amount of blood in the urethra. The perineum showed ecchymosis but no swelling. On rectal examination the rectum was much compressed by a soft mass which extended upward from the triangular ligament as far as the finger could reach. This mass was compressible and soft. The prostate could not be felt. A fracture of the bones of the ischiopubic ramus was made out. A catheter passed into the urethra, penetrated beyond the region of the membranous urethra and evacuated a small amount of coagulated blood. With finger in rectum the end of the catheter was felt to be free in a cavity in front of the rectum and above the triangular ligament. A diagnosis of rupture of the urethra with extravasation of blood, and possibly urine, was made, and the patient advised to go to a hospital, but he refused, so operation was carried out at his home. Operation: Dr. Young; ether anesthesia. An inverted "V" perineal incision was made, the central tendon divided,

and a huge cavity filled with blood clot encountered. Almost a quart of blood was removed. Investigation showed that the membranous urethra was ruptured at a point several millimeters above the triangular ligament. There was a fracture of one ramus of the pubis. The

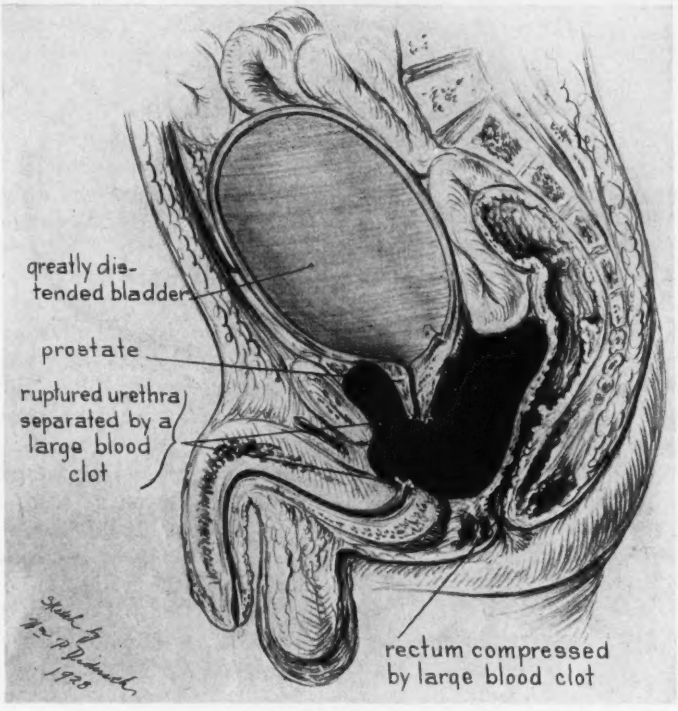
greatly distended bladder
prostate
ruptured urethra separated by a large blood clot
rectum compressed by large blood clot

FIG. 1. CASE 1

Showing prostate torn off from membranous urethra, and pushed upward by huge mass of extravasated blood. Bladder greatly distended with urine.

triangular ligament was apparently intact. The veins and arteries of the periprostatic region had apparently been ruptured. The prostate was found about 2 or 3 inches distant from the membranous urethra and above it a greatly distended bladder. The prostate and bladder had been pushed upward by the large mass of extravasated blood (fig. 1).

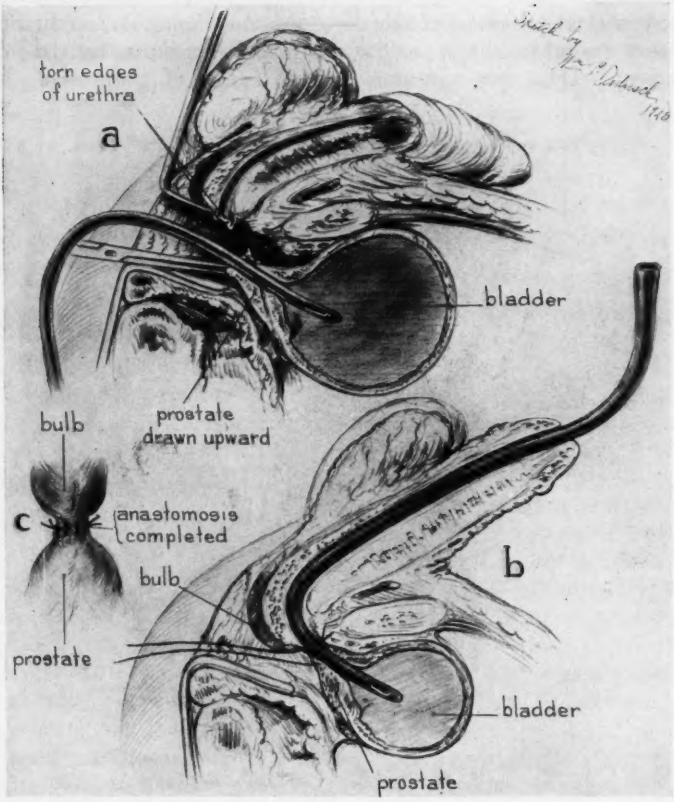

FIG. 2. CASE 1

Showing operation, the drawing downward and anastomosing the prostate with the membranous urethra. *a*, blood clot having been evacuated, the prostate was caught with tenaculum forceps, drawn down, catheter inserted, evacuating 2,000 cc. fluid; *b*, catheter was then introduced through the meatus into the bladder, and anastomosis of urethra with interrupted sutures of plain catgut carried out; *c*, technique of anastomosis.

When this was evacuated it was easy to grasp the prostate with a tooth forceps and draw it down towards the perineal wound where the urethral

opening was detected and easily catheterized. A large amount of urine, probably 2000 cc., was evacuated with a catheter, as shown in figure 2. A catheter was then passed through the meatus out through the tear in the membranous urethra and up through the prostatic urethra into the bladder. Around this catheter anastomosis between the apex of the prostate and the membranous urethra was easily carried out with interrupted sutures of plain catgut. Additional sutures through the adjacent fibrous and muscular tissues were placed to reinforce the first line of closure. A catheter was left in the urethra and fastened in place with strips of adhesive around the shaft of the penis. A small gauze pack was placed in the perineum and brought out through one angle of the round, the remainder being closed with interrupted sutures of catgut. The patient was put on urotropin and water forced by mouth. The convalescence was uneventful. The catheter remained in place with no perineal leakage. The wound healed by granulation, and at the end of three weeks the patient was in excellent condition, voiding urine naturally and the wound was completely closed.

Six months later the patient consulted me complaining that there had been no return of erections since the operation. Sexual intercourse, he stated, had been quite normal up to the time of the accident, but since then it has been impossible on account of complete absence of erections. Examination showed the penis to be flabby and there was no pulsation along the dorsum or elsewhere.

Two months later I was notified by the patient that he was suing the railroad company for $20,000 on account of the accident which had deprived him of his sexual powers. At court I willingly testified and stated that I believed the dorsal artery and also the veins had been severed in the accident, and that this was responsible for his impotence. The judge took the case away from the jury on account of "contributory negligence" on the part of an employee of the railroad company. The patient had his beautiful young wife there to testify, and it was one of the most interesting legal cases I have ever connected with.

A similar case to the one just reported presented the following history:

Case 2. Fracture of the pelvis; rupture of the urethra and left crus of corpus cavernosum; early operation; good result—urination normal; absence of erection of left corpus cavernosum and curvature of penis to that side; coitus markedly impaired.

W. H. C., B. U. I., 11597, aged thirty-five, single, admitted July 17, 1923, complaining of atrophy of the penis and impotence due to fracture of the pelvis six years previously. At that time he stated that the pubic bone was fractured and the urethra torn away from the bladder. Suprapubic drainage had been carried out and a catheter remained in the suprapubic fistula for twenty-nine weeks. After that the patient was able to void urine without difficulty, but complained of impotence which had been present since the accident. He had sexual desire, but erections were imperfect, and he was generally unable to make entrance. Ejaculation occurred, but was very precocious. On examination a long suprapubic scar was visible and also a scar in the perineum which extended from the spine of the ischium to the left of the scrotum and upward as far as the external inguinal ring. There were no sinuses or fistulae present. On rectal examination the right seminal vesicle and right lobe of the prostate were negative. The left seminal vesicle was adherent, the left lobe of the prostate irregular, indurated and adherent, and adjacent to it was an irregular mass of bone which extended outward towards the bulb of the urethra, evidently callous around an old fracture of the left ischiopubic ramus. The bulb of the urethra was very atrophic and indurated in its anterior portion. The left crus of the penis was surrounded by a mass of new bone and the left corpus cavernosum was atrophic and the penis deflected to that side. The patient stated that when erections occurred the penis was bent to the left and erections imperfect.

Impression. Patient's chief complaint was imperfect erections and lateral curvature of the penis. This, I believe, was due to the fact that the crus of the penis on the left side was injured and that it was constricted and bound up with the bony exostosis which resulted from fracture of the ramus of the pubis. The patient did not return for treatment. It is evident that in this case that there had been a rupture of the urethra, and probably of the bladder, associated with fracture of the pelvis. As a result of immediate operation in which suprapubic and probably urethral drainage was provided, the patient was now able to void urine and there was no stricture present. The importance was the result of a traumatism to the blood supply of the penis which had occurred and the exostosis.

This case differs from case 1 in that there was partial erection with filling of the right corpus cavernosum, the vessels of which had apparently not been injured.

Case 3. Complete transverse rupture of the membranous urethra at junction with the prostate; cicatricial obliteration of urethra; plastic operation to excise scar tissue and anastomose separated ends of urethra.

S. I. W., B. U. I. 15420, male, aged thirty-nine years, married, admitted November 18, 1926, complaining of complete obliteration of of the urethra following fracture of the pelvis, and a suprapubic fistula. On May 20, 1925, eleven months ago, the patient was crushed by a heavy telegraph pole which knocked him down and fell across his pelvis. Investigation showed a fracture of the pelvis and of the right femur and rupture of the bladder. He was treated by suprapubic drainage. A

FIG. 3. CASE 3

Fracture of pubis and ischio-pelvic rami. Tube emerging

few weeks later an abscess appeared in the perineum and was incised. For a time urine escaped through the perineum and through the urethra but later the suprapubic wound reopened and after that no urine had passed through the penis or through the perineum which had healed completely.

Examination. Patient was wearing a suprapubic catheter. To the right of the midline in the perineum there was a scar about 2 cm. long. About the middle of this scar was a sinus into which a filiform could be passed for a distance of 5 cm., but it did not apparently enter the bladder. Filiforms which were passed through the meatus met with

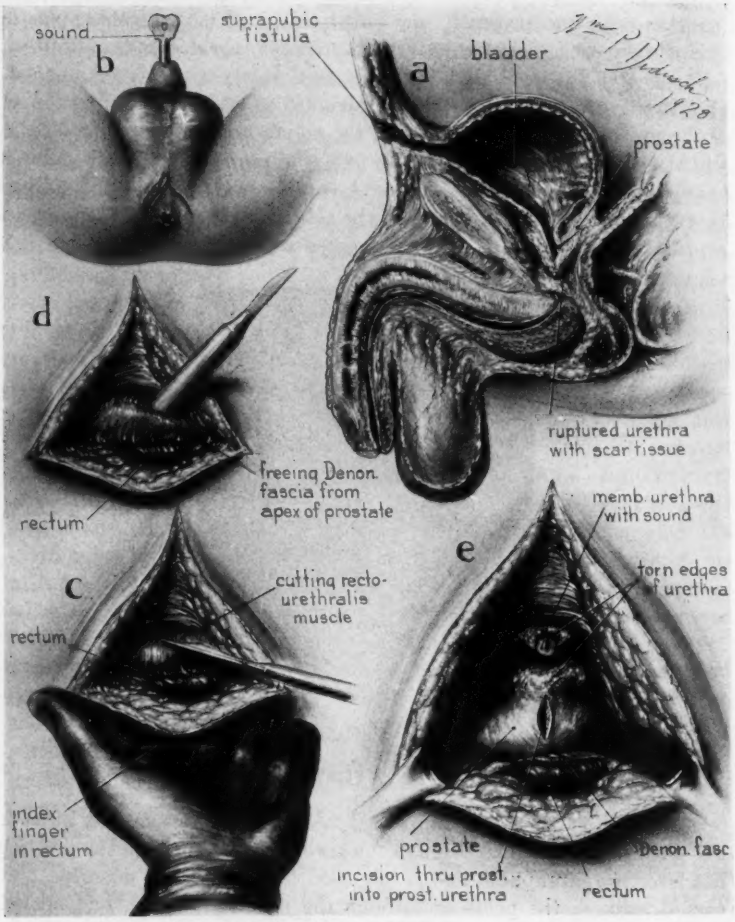

FIG. 4. CASE 3

a, sagittal section showing the conditions present; *b*, skin incisions; *c*, use of finger in rectum during dissection from membranous urethra and prostate; *d*, stripping back Denonvilliers' fascia, after which the prostate was exposed; *e*, scar tissue has been largely excised, opening up the membranous urethra. On the posterior aspect of the prostate is the site of incision made upon a sound passed through the suprapubic wound.

obstruction in the region of the membranous urethra. Sounds and catheters passed no farther. On rectal examination the tip of the sound was felt in the region of the triangular ligament, and back of this a

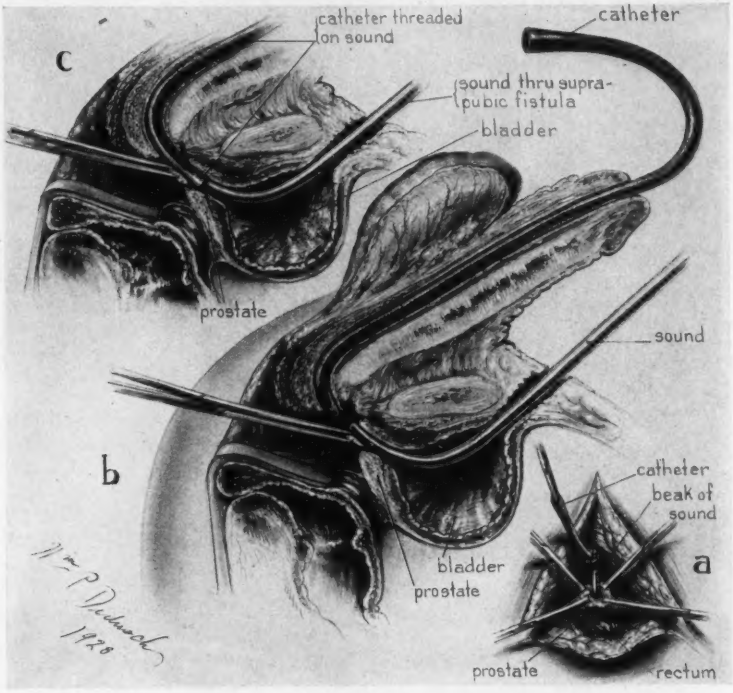

FIG. 5. CASE 3

Technique of anastomosis. In *a* and *b* the catheter in the anterior urethra, and the sound emerging from the apex of the prostatic urethra are shown. In *c* the tip of the catheter has been cut off, the end of the sound passed into the catheter, and then withdrawn from the suprapubic wound, pulling with it the catheter into the bladder, where it was left for drainage.

large indurated mass was felt, and at a point about 2 or 3 cm. above the triangular ligament the prostate was palpable. It was apparently about normal in size. The seminal vesicles could not be reached. Between the apex of the prostate and triangular ligament was the

irregular cicatricial mass above described. After removing the suprapubic tube a cystoscope was passed into the bladder. The prostatic orifice was visible, and into it a urethral catheter could be inserted for a distance of about 3 cm. The bladder was negative. The x-ray is

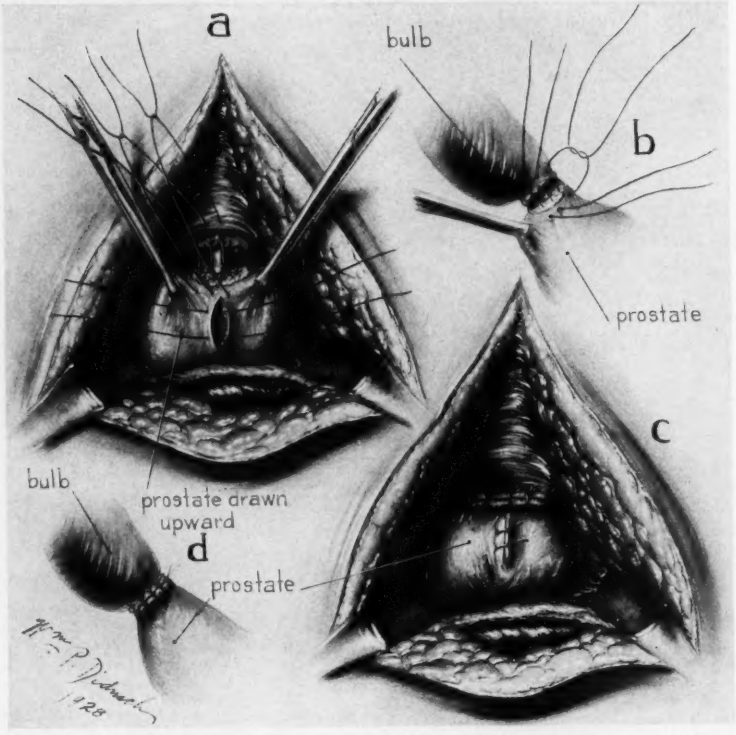

FIG. 6. CASE 3

Anastomosis of prostatic and membranous urethra

shown in figure 3. A large tube is seen emerging from the bladder, and passing out towards the left. Extensive fractures of the ischiopubic rami and pubis are shown.

Impression. Complete obliteration of the urethra due to transverse rupture and separation of the prostate from the membranous urethra by a mass of scar tissue.

December 13, 1926, operation. Dr. Young, gas, oxygen and ether anesthesia. An inverted "Y" incision was made in the skin of the perineum fig. 4, *b*. The central tendon was divided and beneath it a large mass of fibrous tissue was encountered which bound the rectum

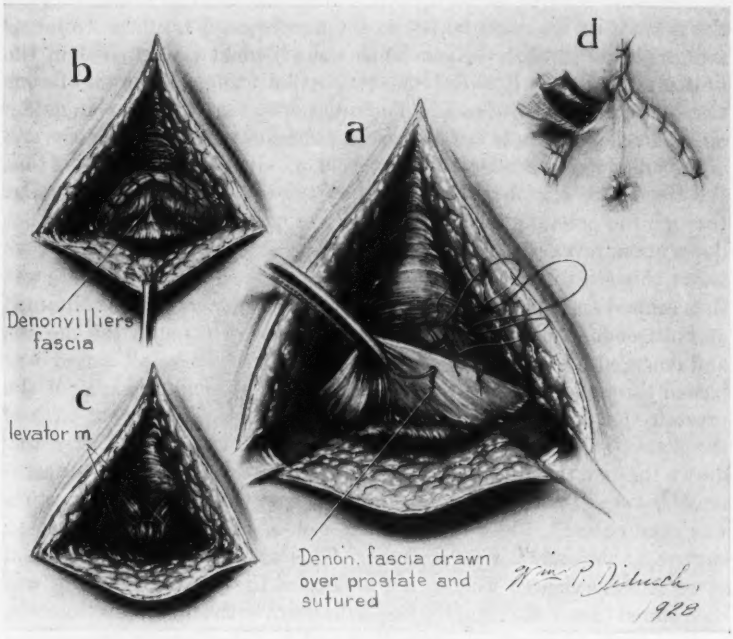

FIG. 7. CASE 3

Completion of anastomosis and closure of wound. After the anastomosis has been completed (*a*); the fascia of Denonvilliers was sutured across the incised wound on the posterior surface of the prostate, (*b*); reinforcement was obtained by drawing the levators (*c*); and the skin was closed with drainage on one side (*d*).

closer to the deeper structures. Normal tissues could not be detected, and in order to avoid injury of the rectum a finger was inserted and the rectum separated with a scalpel from the cicatricial mass above the triangular ligament (fig. 4, *c*). Proceeding thus, (fig. 4, *d*) the apex of the prostate was eventually disclosed, and by blunt dissection the rectum

freed from the base of the prostate and the lower portion of the seminal vesicles. An excellent view was thus obtained. The conditions present are shown in the sagittal section *a*. As seen here, the prostate has been torn off from the membranous urethra and the two are separated by a considerable cicatrix, as shown in *a*. When a sound was passed through the urethra its tip could be felt in the membranous urethra. Another sound, passed through the surapubic wound, could be palpated in the prostatic urethra. Between the two sounds was a layer of fibrous tissue about 3 cm. in length. The urethra was apparently completely obliterated, as shown in the figure. An incision was made upon the end of the sound in the prostatic urethra fig. 4, *e*. Investigation showed that the tip of the sound had not reached the apex of the prostate, but through the prostatic incision a sound was passed to this point and cut down upon, revealing the true end of the prostate. The mass of fibrous tissue between the membranous urethra and the end of the prostate was then excised and the urethra freed until fairly normal tissue was obtained at both ends. A catheter was then introduced through the meatus and emerged into the perineal wound (fig. 5, *a*). A small sound was passed through the suprapubic wound and out through the apex of the prostate (fig. 5, *b*). The end of the rubber catheter was then cut off, and the sound having been introduced into the catheter, the latter was drawn through the prostatic urethra into the bladder (fig. 5, *c*). Anastomosis between the two separated ends of the previously ruptured urethra was then effected, using first a single row of plain catgut interrupted sutures, as shown in figure 6, *a* and *b*. This was reinforced by additional sutures. The incised wound in the floor of the prostatic urethra was then closed (figure 6, *c*) and the fascia drawn over the line of anastomosis, and sutured, as shown in figure 7, *a* and *b*. The levator ani muscles were approximated fig. 7, *c* and the skin closed with interrupted sutures of silk-worm gut, drainage with gauze being supplied at one angle fig. 7, d. Drainage of the bladder was maintained both by a suprapubic tube and also by the catheter in the urethra.

Convalescence. This was somewhat complicated and prolonged. Filliforms and followers were necessary, and one of the assistants, in passing sounds, produced a false passage at the vesical neck. With a cystoscope passed through the suprapubic wound, an opening into the bladder was seen below the normal orifice. Eventually this healed completely, patient voided urine naturally through the urethra and the suprapubic healed solidly. He left the hospital in good condition and a note on April 25, 1927, stated that a sound passed into the bladder without difficulty, and that the patient was voiding urine normally.

Case 4. Fracture of pelvis; partial rupture of membranous urethra; suprapubic and perineal drainage; operation—excision of scar tissue; plastic to cover urethral defect.

P. J., B. U. I. 14773, man, aged thirty-six, single, admitted May 11, 1926, complaining of perineal fistula following an operation which was necessary after fracture of the pelvis. In June, 1925, while working at a lumber mill, a log rolled over him, fractured the pelvis in three places, and severed the urethra. He was operated on by a physician who evidently carried out perineal section and passed a catheter through the urethra into the bladder. Suprapubic drainage was also afforded.

After that the patient had a perineal fistula and was able to pass only a few drops of urine through the urethra. He had urinary control,

FIG. 8. CASE 4

X-ray showing fracture of the pelvis

voided at intervals, and with good force through the fistula. He was passing nothing through the penile urethra on admission. He had not been able to have sexual intercourse since operation. He occasionally had nocturnal emissions which came out through the fistula. There was a suprapubic scar, but no fistula. In the perineum there was a scar in which the urinary fistula was found at a point about 2 inches in front of the anus. Through the fistula it was possible to pass a filiform into the bladder, and a No. 20 following dilator entered easily. A sound passed through the urethra met with an obstruction in the membranous region. It did not come in contact with a sound passed into the bladder through the fistula. The prostate was normal in size, slightly indurated and adherent, and both vesicles were negative. The membranous

urethra was surrounded by a mass of fibrous tissue. A deformity of the pelvic bones resulting from fracture was made out. This is well shown in the x-ray (figure 8).

Impression. Complete rupture of and resultant obliteration of the membranous urethra; perineal urinary fistula.

October 14, 1926, operation. Dr. Young, gas, oxygen and ether. A probe was passed through the fistula into the bladder. Urethrotomy through the bulbous urethra was made upon Young's urethrotomy staff. The perineal urinary fistula was then excised. It was found to enter the urethra near the apex of the prostate. With a sound in the bulbous urethra scar tissue about 1 cm. in width was found to block the membranous urethra. This was excised and it was then possible to pass a sound through the penile urethra into the bladder. It did not seem desirable to free either the two ends of the urethra and bring them together, as this would possibly have necessitated injury to the sphincter muscle and perhaps some of the blood supply, but the tissues were drawn together around a rubber catheter. The two ends of the urethra were approximated as well as possible, and the soft tissues drawn together over them, resulting in satisfactory closure. Additional sutures through the adjacent tissues, for reinforcement, were placed. The wound was closed with a small gauze drain. The convalescence was satisfactory. The catheter was removed during the second week, and dilatations during the third week with filiforms and followers were carried out. The patient was discharged on June 19 in excellent condition, voiding urine at normal intervals. September 30, 1927, letter: "It is now over a year since the operation. I void urine normally; have had a sound passed occasionally, but there is no stricture."

In this case, owing to the short distance between the two ends of the urethra, complete resection and anastomosis was not carried out. The mucous membrane was drawn together by sutures and where the membrane was absent normal muscle and fascia were applied over the sound in the urethra. The result obtained was excellent.

Case 5. Fracture of pelvis; rupture of urethra; marked injury to external and internal sphincters; suprapubic and perineal incisions for drainage; subsequent development of calculi in bladder and urethra and vesicourethral fistula. Operation—removal of calculi; Young's double sphincter plastic to cure incontinence.

C. J. D., B. U. I. 9234, man aged forty-two, widower, admitted November 18, 1920, complaining of urinary fistula in the perineum. Three years before the patient had been run over by a motor truck and sustained a fracture of the pelvis. He was taken to a hospital in Boston, where an operation, which involved suprapubic and perineal incisions, was done. Patient stated that a large piece of bone was

FIG. 9. CASE 5

Longitudinal section showing presence of vesical and urethral calculi and fistula paralleling prostatic urethra and leading from anterior wall of the bladder to the bulbous urethra. Both internal and external sphincter dilated. Perineal fistula.

removed through the perineal wound. After that he had had a perineal fistula and occasionally a suprapubic fistula. Recently the suprapubic wound had healed, and all the urine was passing through the perineal opening. He had considerable pain, frequency and difficulty of urination. There was a large suprapubic scar. There was a perineal fistula with an extensive perineal cicatrix. On rectal examination the prostate was markedly indurated. The base of the bladder felt very hard.

Palpation of the perineum revealed a hard, oval mass adjacent to the fistula. On insertion of a probe a stone was found. An X-ray film showed a large stone in the bladder, and a small oval stone back of the symphysis pubis. A sound was passed through the urethra and met

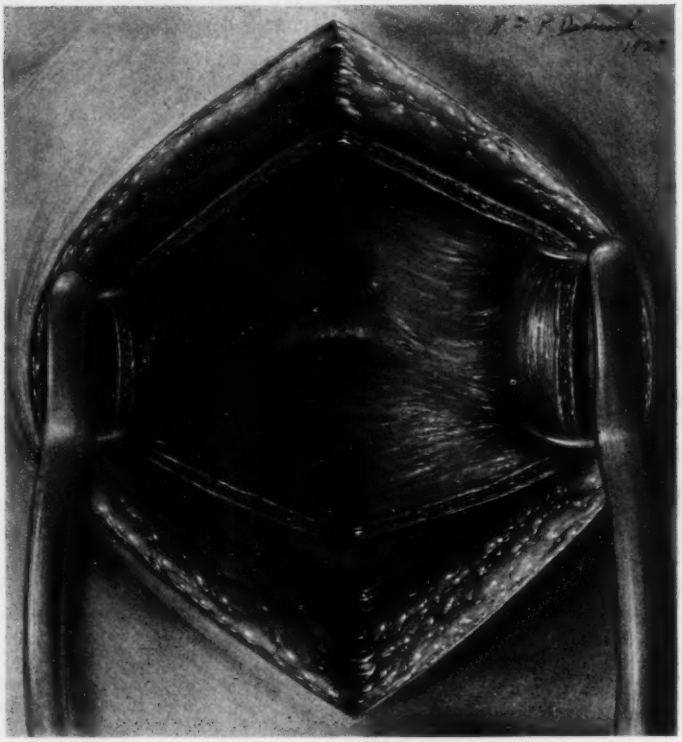

FIG. 10. CASE 5

Showing internal orifice of pre-prostatic vesical urethral fistula. Prostatic orifice dilated.

with obstruction in the bulbo-membranous region. It was impossible to pass a catheter into the bladder.

Impression. Vesical calculus; urethral calculus; perineal urinary fistula. The condition present is shown in fig. 9.

November 23, operation. Dr. Young, gas, oxygen and ether anesthesia. Perineal and suprapubic operations to remove calculi in urethra and bladder. Partial excision and curettage sinus running from bladder to perineal urethra. Suprapubic incision closed. With the patient in the perineal prostatectomy position, a median line incision encircling the perineal fistula was made. A stone was encountered in the urethra and removed. It measured 2.5 cm. in length and 1 by 1.5 cm. in thickness. It lay in the region of the membranous urethra and apex of the prostate and was surrounded by much cicatricial tissue. Just in front of the stone and entering the roof of the urethra obliquely was a fistulous tract through which a probe could be passed into the

FIG. 11. CASE 5

a, excision of fistulous tract; *b*, closure of vesical orifice of fistula

bladder, as shown in figure 9. It seems probable that the urine escaped through this false passage as the stone seemed to block the prostatic urethra completely. After removal of the stone from the urethra a finger could be introduced through the prostatic urethra into the bladder without difficulty, and the large stone in the bladder could be felt. This was removed through the suprapubic wound. After removal of the vesical calculus suprapubically the prostatic orifice was seen to be slightly dilated. On the anterior wall of the bladder, at a point 1.5 cm. distant from the prostatic orifice was the orifice of the fistula which led to the membranous urethra (fig. 10). This was thoroughly curetted from above and below, and the suprapubic bladder incision carried downward until the opening of the fistula was reached. The scar

tissue surrounding it was then curetted and partially excised and the prevesical region packed with iodoform gauze. The bladder was

FIG. 12. CASE 5

The posterior and lateral margins of the dilated prostatic orifice have been resected and sutures are being placed by Young's Boomerang needle holder. The completion of this closure to narrow the internal orifice is shown in *a*. Catheter was removed.

partially closed and the lower portion packed with gauze. The perineal wound was partially closed and also packed with gauze. It seemed

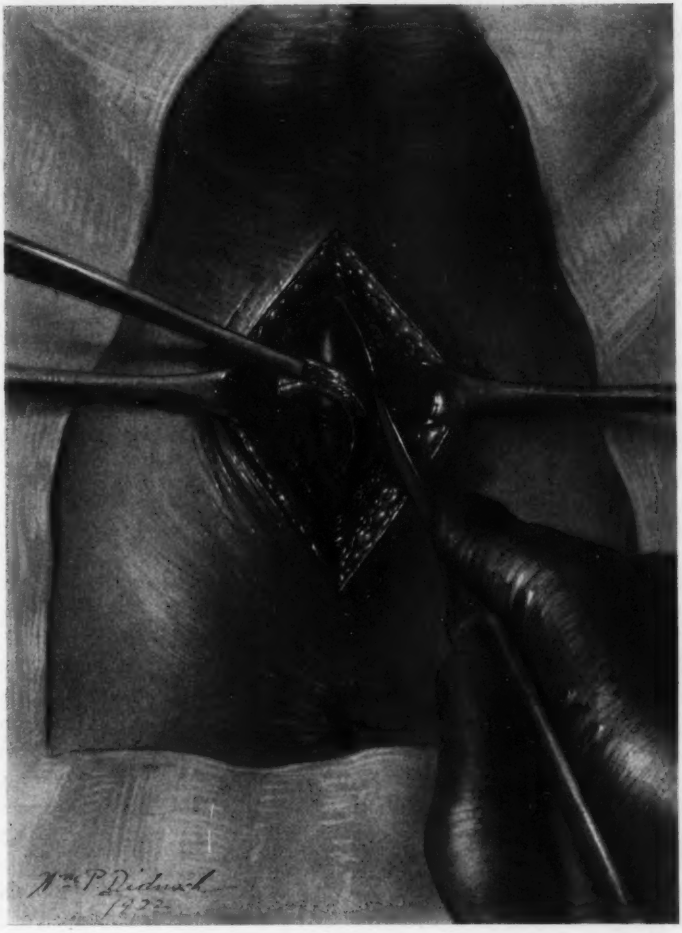

FIG. 13. CASE 5

Excision of redundant urethra in region of triangular ligament and external sphincter.

probable that the region of the external sphincter had been gravely injured in the accident, and the operator was uncertain whether the patient would have incontinence or not.

Convalescence. Suprapubic drainage was maintained, but most of the urine escaped through the perineal sinus for one month, after which it slowly diminished, but never closed completely. Finally on April 4 an operation was done to remove the necrosed pelvic bone. The right half of the ramus of the pubis was explored and a portion of the bone removed with a chisel, but no osteomyelitis was encountered.

April 24, suprapubic wound healed. The patient reported that he was incontinent. He was unable to hold urine for more than 15 minutes. Urine pased out through the perineal fistula and partly through the penile meatus. An instrument passed into the bladder without difficulty. There was no evidence of stricture. On rectal examination the membranous urethra was much larger than normal, and the wall indurated. The prostate was about normal in size, and slightly indurated. May 12, 1921, incontinence continued. It seemed necessary to operate to cure.

Operation. Dr. Young, gas, oxygen and ether anesthesia. First, suprapubic cystostomy; investigation of the bladder. About 2 cm. distant from the prostatic orifice was a fistulous opening on the anterior wall of the bladder through which a probe could be passed out below the symphysis pubis, emerging from the perineal wound. This fistulous opening in the bladder was excised and closed completely (fig. 11). The prostatic orifice was found to be dilated, and the posterior margin, and a portion also of the tissues of the lateral margins of the prostatic orifice were denuded of mucous membrane. The orifice was then drawn together by the insertion of four chromic catgut sutures with Young's boomerang needle holder (fig. 12). This made the orifice quite tight (fig. 12, *a*), and no catheter was left in it. The bladder was closed except at the upper angle of the wound where a dePezzer catheter emerged for drainage. The patient was then placed in a perineal position and the scar tissue of the perineal sinus excised. The redundant urethra and fibrous tissue surrounding it was resected in the region of the membranous urethra (fig. 13). The muscle was thus exposed on each side and the wound then closed in layers with chromic catgut around a catheter. The mucous membrane was first approximated, fig. 14, then the periurethral muscle in the region of the sphincter, fig. 14, *a*, and then the superficial muscles, fig. 14, *b*. Approximation was thus obtained and the perineal wound completely closed. In this procedure

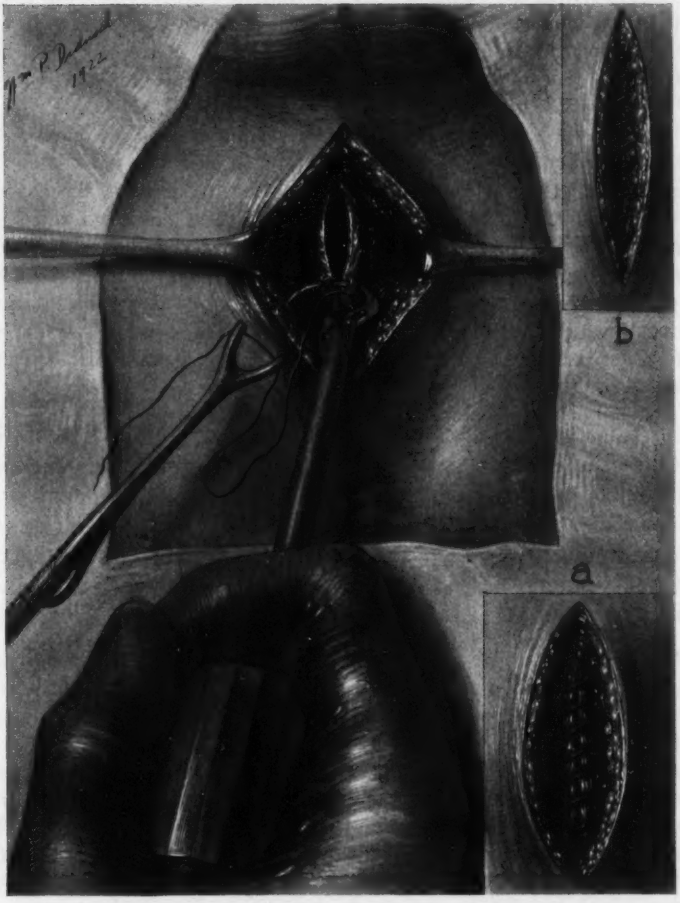

FIG. 14. CASE 5

Closure of membranous urethra with "boomerang needle holder." Mucous membrane inverted. *a*, approximation of deep perineal muscle around urethra; *b*, closure of superficial muscle and fascia. Skin left open.

a large cavity in the region of the membranous urethra which was found lined with mucous membrane was almost completely excised. It was evident that the triangular ligament and muscles of the perineum had been badly injured in the accident. The urethral catheter was removed at the end of the operation.

Convalescence. Suprapubic drainage was maintained for one month. Three days later the patient voided naturally and two days later the suprapubic wound healed completely. July 16, patient discharged. There had been no leakage of urine through the perineum since the second operation, and the suprapubic wound had been healed for three weeks. The patient was able to retain urine for three hours, and voided in a good stream with good control. June 2, 1922, letter: "I void urine naturally at intervals of five hours, have good control, have had no sounds or catheters passed. Have had no erections since the accident. General health is excellent."

In this case it is evident that in addition to rupture of the urethra there was marked injury of the external sphincter and dilation of the internal sphincter. The removal of calculi was not sufficient to cure the patient, and the second operation, in which Young's double plastic operation upon the internal and external sphincters for cure of incontinence was necessary and, was carried out successfully.

Case 6. Fracture of pelvis; rupture of urethra; operations for drainage; complete obliteration of urethra at the apex of the prostate; formation of vesico-perineal fistula; resection; third operation to resect stricture.

J. F., B. U. I. 10365, male, aged thirty-four, married, admitted March 17, 1922, complaining of traumatic structure of the urethra. Three years before (November 6, 1919) his pelvis was crushed by the fall of a telegraph pole which ruptured the bladder. Suprapubic and perineal operations were carried out. The patient had not been able to pass urine satisfactorily since. A second external urethrotomy was done without success. On admission urine escaped both through the perineal fistula and the normal meatus. Erections had been very imperfect since the accident, and there had been complete absence of ejaculations. At times the patient's bladder became distended and overflow incontinence occurred. He had been forced to catheterize himself almost daily for the past six months. On examination the

patient was wearing a retention catheter. The perineum had a scar in the center of which was a fistulous opening. On rectal examination the prostate and vesicles were normal in size, and only slightly indurated and adherent. A catheter was introduced and a cystogram taken. The bladder capacity was 600 cc. The patient then stood up and the bladder fluid dribbled continually, apparently showing that both internal and external sphincters had been injured. A cystoscope entered easily and an irregular and dilated prostatic urethra (as it was supposed) was seen. In figure 15 the X-ray shows fracture of the

FIG. 15. CASE 6

Cystogram showing dilated vesical neck; fracture of pubes

pubis and dilation of the prostatic urethra. It was evident that an operation to cure the incontinence was indicated."

Operation. March 23, 1922. Dr. Colston, gas, oxygen and ether anesthesia. Suprapubic cystostomy. On examining the bladder two openings were found on the anterior wall which readily admitted the tip of the index finger and were separated from one another by a thick bridge of tissue covered with mucous membrane, and about 1 cm. in width, as shown in figure 16. About 2 cm. below the lower opening another was found which was recognized to be the prostatic orifice. A finger introduced into the prostatic urethra passed for about 2 or 3 cm. when it was

completely obstructed. It seemed evident, therefore, that the urethra had been ruptured, the prostate torn off from the membranous urethra, and that a tight stricture had formed at the apex of the prostate and that the urine escaped through the fistulous tracts in front of the prostate. The cystoscope had passed through one of these into the bladder. A sound was then introduced into the prostatic urethra, and forced through the point of cicatricial closure until it could be palpated in the membrane urethra through the fistulous tract. Additional sounds up to No. 32 were introduced to dilate the urethra, and a No. 30 catheter passed through the meatus and the prostatic urethra into the bladder.

FIG. 16. CASE 6

Longitudinal section showing preprostatic, vesico-urethral fistula with two orifices in bladder; obliterating stricture at apex of prostate.

The margins of the vesical fistulae and tissues between them were resected, and the tract followed down to where it connected with the urethra external to the apex of the prostate. The tissues around the fistulous tract were removed partly by dissection and partly by curettage. With Young's Boomerang needle holder the periurethral tissues were drawn together around a catheter in the urethra, and a second reinforcing layer of sutures was introduced. No 2 chromic catgut was employed. The opening of the fistula into the bladder was closed (fig. 17), and the suprapubic wound brought together with chromic catgut, leaving a space at the upper angle for drainage. When a finger

was introduced into the internal sphincter it was found quite tight, so that it seemed unnecessary to operate upon this. April 1; postoperative course quite uneventful. The catheter was removed on the eighth day from the urethra, and also from the suprapubic region. A Coudé catheter was reintroduced into the urethra with a stilet. Suprapubic drainage was not continued.

June 16, 1922, discharge note: Patient is voiding urine naturally at an interval of four hours with good control and without difficulty. There is a small perineal urinary fistula present.

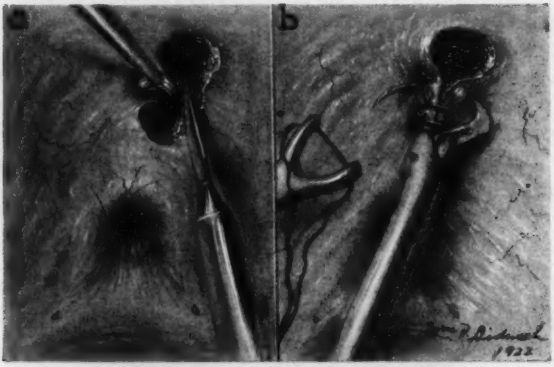

FIG. 17. CASE 6

a, excision of margins of fistulae and intervening septum; *b*, closure of vesical orifices or fistulae in two layers.

September 19, 1922, patient was readmitted on account of stricture of the urethra. He was voiding urine with much difficulty in a very small stream. A perineal fistula was still present. The suprapubic wound had reopened several times.

September 20, 1922, operation, Dr. Colston, gas, oxygen and ether anesthesia. Attempts to pass filiforms having failed, a No. 22 sound was introduced to the region of the stricture in the membranous urethra, and a median perineal incision made through the scar of the first operation done at the time of accident. The usual landmarks in the perineum were completely obliterated. It was necessary to strip the rectum back and open the ischio-rectal fossa. Attempts to find the urethra in the retracted area failed, but by careful dissecting the dilated proximal

end of the urethra was found and a sound passed with ease into the bladder. Scar tissue was excised and finally a tortuous urinary tract through the strictured area was discovered. A No. 26 rubber catheter was then introduced through the anterior urethra and thence through the prostatic urethra into the bladder. "It could be definitely seen that the mucosa of the bulbous surface of the urethra was injured." Where the scar tissue of the strictured area had been dissected this was covered up by dissecting two flaps of tissue as free as possible from the scar tissue. These were united over a catheter with interrupted catgut stitches. The perineum was closed with interrupted plain catgut for the deeper structures and metal clips for the skin. The suprapubic fistula was curetted.

Convalescence: The catheter was removed from the urethra in a week, and the perineal fistula closed a week later. On October 13 the patient was cystoscoped without difficulty and nothing abnormal was discovered. October 14, patient was discharged. He was voiding urine freely with good control, but he was sexually impotent, on account of absence of erections. December 14, 1922, letter: "I am voiding urine normally and without pain."

Case 6 resembles case 5 in that there was a vesical perineal fistula which passed from the anterior vesical wall to the perineum in front of the prostate. There was no stone present, but there was a fracture with complete obliteration of the urethra at the apex of the prostate as a result of the rupture. In this case it was necessary to do a second operation through the perineum to repair the defect and to reconstruct the urethra around a catheter, as in case 5.

Case 7. Fracture of pelvis; rupture of urethra; drainage—suprapubic and perineal; catheter left in urethra; rectourethral fistula; second operation—Young-Stone technique to cure rectourethral fistula.

E. L., B. U. I. 8618, male, aged nine years, admitted February 5, 1920, complaining of difficulty of urination following injury. Six months ago the patient was run over by a truck. It was thought that the injury was not severe, but a few hours later blood was seen coming from the urethra. The abdomen began to distend and he was unable to urinate. At the hospital an unsuccessful attempt was made to pass a catheter and then perineal and suprapubic incisions were made and a drainage instituted. Later a catheter was passed through the urethra

into the bladder and left in place. Finally the urethral catheter was removed and for a time he voided naturally. Of late urination has become progressively more difficult, on admission and almost all the urine escaped through the suprapubic sinus. Examination revealed a suprapubic fistula, a depressed scar in the perineum, in the center of which was an opening through which gas escaped from the rectum fig. 18. Urine was said to escape through the perineum at times. On rectal examination the opening of a rectourethral-perineal fistula was

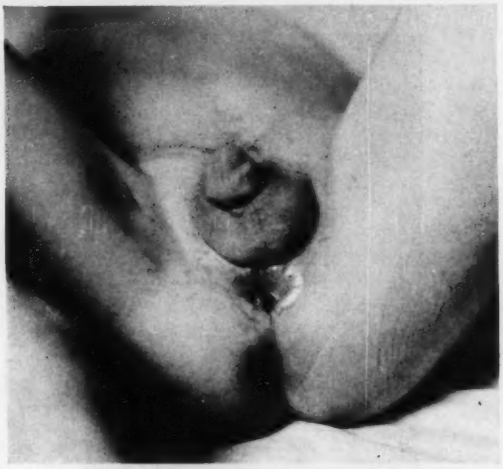

FIG. 18. CASE 7

Photograph showing depressed scar in perineum with fistula which connected both with rectum and urethra.

distinctly palpable. The prostate and vesicles were apparently negative. The X-ray showed fractures of pubic bones, stone in bladder, fig. 19.

February 11, operation, Dr. Young, ether anesthesia, Young Stone operation to cure rectourethral fistula. Urethrotomy for stricture of the posterior urethra.

Suprapubic drainage was first afforded. The patient was then placed in the perineal position and a racquet incision in the perineum and around the anus was made, as usual. The typical operation was carried out. The rectal mucosa was freed to a point above the fistulous com-

munication with the urethra which was divided. The perineal fistula and scar tissue surrounding it was resected, and a long prostatic tractor used effectively in drawing down the prostate for the deeper dissection (fig. 20). The wound in the prostatic urethra was then closed in layers with the Boomerang needle holder and chromic catgut (fig. 21). The rectal mucosa was drawn downward (fig. 22) and resected thus completely removing the fistulous opening. Sutures of chromic catgut were then inserted and interrupted sutures of silk to approximate the mucous membrane and the skin. Suprapubic drainage was pro-

FIG. 19. CASE 7

X-ray showing extensive fractures of pelvic bones and vesical calculus

vided. No urethral catheter employed. The perineum was superficially packed.

March 2, 1920, patient has had a very satisfactory convalescence. Rectum has healed solidly. No fistula present. The patient voiding urine through the urethra without difficulty. Sounds up to No. 16 passed through the urethra into the bladder. March 30; patient was discharged today. All wounds were healed completely. No fistula was present, and a No. 23 sound passed without difficulty. No stricture present. Urination was normal and with excellent control. General condition good.

FIG. 20. CASE 7

Showing long urethral prostatic tractor introduced into bladder, opened out, and traction made, to draw down prostate and facilitate separation of rectum above point of fistula.

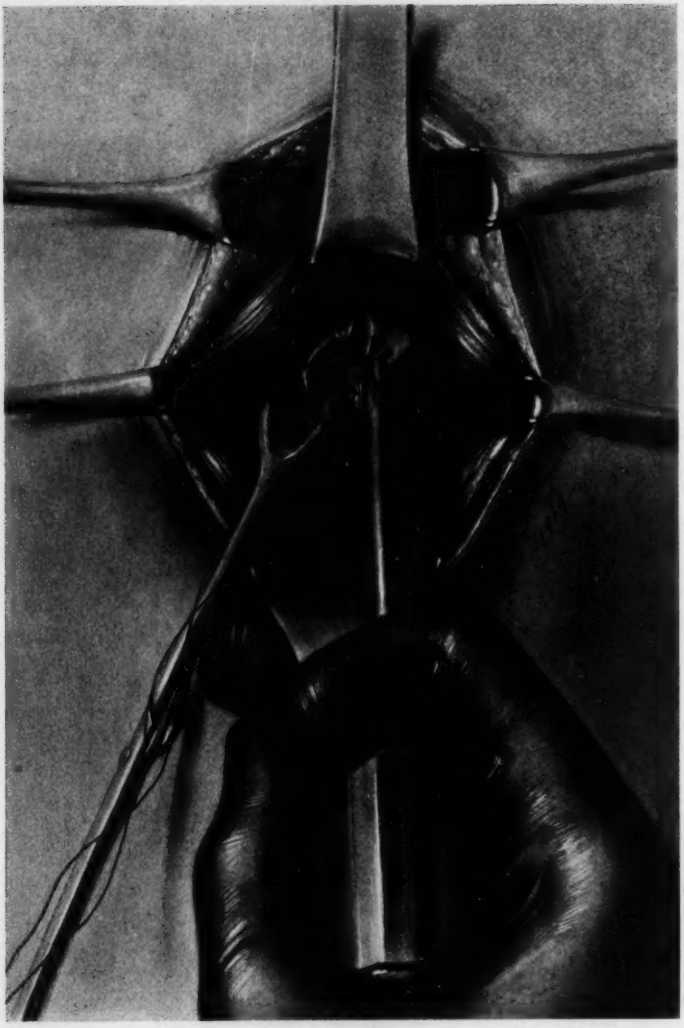

FIG. 21. CASE 7

Boomerang needle holder which is used in suturing the urethral mucosa

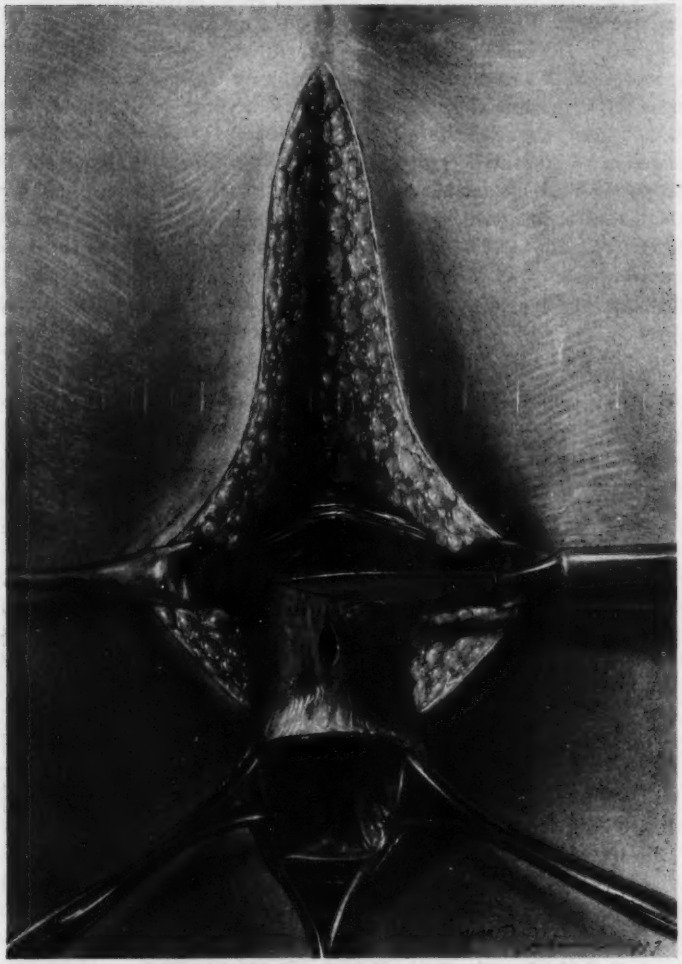

FIG. 22. CASE 7

The rectal cuff is drawn down until the fistulous orifice is external to the skin. Anchor sutures are then placed, and the rectal cuff with fistulous tract excised.

Case 8. E. W., B. U. I. 5100, male, aged thirty years, married, admitted May 10, 1916, complaining of suprapubic fistula following operation. He had been struck by an automobile five months before. He was unable to void urine and suprapubic cystotomy was done. Subsequently urination through the urethra became progressively more difficult and the suprapubic fistula reopened. X-ray examination showed a comminuted fracture of the pelvis involving the right and left pelvic and ischial bones. Urethral instrumentation showed no evidence of stricture. It was possible to pass sounds up to No. 28F. without difficulty. The suprapubic tube was removed and in a short time the patient began to void naturally through the urethra, and the fistula gradually healed. He was discharged on June 1, the suprapubic fistula having been closed ten days. He voided urine at intervals of five hours. The general condition was excellent.

It is difficult to explain the symptoms before entering the hospital. It is possible that there was a membranous obstruction in the urethra from the injury which obstructed urination, and which was not detected when the sounds were passed. At any rate, the patient was apparently cured by urethral dilatations.

Case 9. S. E. C., B. U. I. 7706, male, aged thirty-three years, married, admitted May 1, 1919 with fracture of the pelvis and ruptured bladder. He was in a comatose condition. Two weeks before the patient had been caught between an engine and car and suffered an injury of the lower urinary tract resulting in retention of urine. After the accident the patient required catheterization, the urine being bloody at the first catheterization. The catheter was said to enter easily. During the first week following the accident, the patient was in a fairly good condition, but he afterwards developed fever and the urine became very purulent.

On admission an x-ray film showed fracture to the right and left of the symphysis pubis. A large amount of very purulent urine was evacuated with a catheter. The patient's condition was so desperate that he was put to bed and died in a few hours. Autopsy showed six fractures of the pelvis. The bladder was not ruptured. There was a rupture of the membranous urethra which opened into a large abscess cavity in front of the rectum.

This case is an excellent example of the danger of non-operative treatment in these cases of rupture of the urethra. It seems

probable that the rupture of the urethra in this case was not complete, as no difficulty had been experienced in introducing the catheter into the bladder and withdrawing the urine. A large abscess, however, had formed around the point of urethral injury, and this led to septicemia and the fatal ending. Perineal drainage, with an immediate repair of the urethral injury, and the addition of suprapubic drainage would probably have given a good result, as in the other cases which have been reported above.

COMMENTS ON THE PRECEDING CASES

These cases show the importance of early operation and accurate repair of the urethral defect in cases of traumatic rupture of the urethra. The failure to carry this out was the cause of death in the last case, and led to serious complications in several of the others. In these cases it was necessary to carry out extensive secondary operations to cure fistulae, and to relieve the patient of incontinence of urine. In those cases where immediate operation was done, excellent results were obtained and the serious complications described in the other cases avoided. It is evident that in cases of fracture of the pelvis, careful investigation of the urinary tract should be made. In almost every case where the posterior urethra is ruptured, the safer procedure is to go in at once, and to carry out anastomosis if the rupture is complete, as in case 1, or closure of the defect over a catheter, as shown in case 2. With perineal and suprapubic drainage the danger of infection is thus avoided, and excellent results obtained. The cases enumerated above in which this was not done have finally been cured by very extensive operations which involved resection of the vesical perineal fistulae, Young's double plastic sphincter operation for incontinence of urine and the Young-Stone operation for recto-urethral fistulae. By early operation carried out as soon as possible after the accident, these extensive secondary procedures would probably have been avoided in all cases.

A COMPARATIVE STUDY OF TUBERCULOUS LESIONS OF THE UROGENITAL TRACT[1]

CHARLES MORGAN McKENNA AND HENRY C. SWEANY

Although tuberculosis of the urogenital tract is commonly thought to be well understood, there are perhaps still some aspects from which new information of practical value may be derived. In meditating on the problem we have been impressed with the following facts: first, the difficulty of arriving at an absolute diagnosis clinically; second, the difficulty of arriving at a complete diagnosis from either surgical or post-mortem material, and third, the need for a correlated study of clinical, pathological and bacteriological findings in genito-urinary tuberculosis. By such a procedure only, will we be able to form a correct opinion of the onset, progress and termination of the disease in all its manifestations.

Urologists generally possess well crystallized ideas regarding genito-urinary tuberculosis that is commonly met with. The general opinion seems to be that the disease is most commonly hematogenous, involving one kidney first or one epididymis with a spread from these points to other parts of the tract. Variations from these routes occur, but they are considered of minor importance. Statistics on the subject may be of some help.

The incidence of genito-urinary tuberculosis depends upon the type of patient. In pulmonary tuberculosis Hübner (1) states that 3 to 5 per cent reveal genito-urinary lesions while 50 to 70 per cent of extra-pulmonary tuberculosis have urogenital tuberculosis. Fowler and Godlee (2) found genito-urinary involvement in 5.27 per cent of pulmonary tuberculosis. Krzynicki

[1]From the Research Laboratories of the City of Chicago Municipal Tuberculosis Sanitarium.

(3) 5 per cent; Hesse (4) in over ten thousand tuberculous cases found only 2.13 per cent with genito-urinary tuberculosis. Of the various parts of the genito-urinary tract involved, Scott (5) quotes various authors to show that about 60 to 75 per cent of genito-urinary tuberculosis involves the prostate but is mostly secondary to infection elsewhere in the genito-urinary tract. The kidney and epididymis perhaps will show a similar percentage although no definite figures are given. Relative to pulmonary involvement in genito-urinary cases, Scott, (5) cites references to show that from 27 to 80 per cent of genito-urinary cases have pulmonary disease. Perhaps all who do not have it will develop it before death if they die from this disease.

Of all the forms, renal infection is considered to be of the most importance. This is perhaps due to the fact that it is the earliest identified. A few opinions will be cited on this phase of the subject.

Hammond (6) considers that 92 per cent of renal tuberculosis appears first in one kidney by the hematogenous route. It begins either in the apex of the papillae or at the cortico-medullary junction. It may spread to the other kidney by vesical or ureteral extension. Pathologically, there are three types: the ulcero-cavernous with constant urinary findings and no enlargements; the hydronephrotic with enlargement and intermittent urinary findings; and the caseous in which no urinary findings may be present. Although Vaccaro (7) considers the possibility of a tuberculous genito-urinary infection arising from bacilli that have passed the respiratory passages without lesion, the most likely origin is from some remote focus of infection. Nitch (24) divides renal tuberculosis into two groups, surgical and medical, depending on the origin. The former arises from some latent focus, while the latter arises from some other massive involvement elsewhere, is bilateral and is at no time surgical. He states that many times the surgical variety is also bilateral from its inception as animal inoculation will frequently reveal. Animal inoculation, however, is not entirely dependable, as shown by Morse and Braasch (8). They found that the guinea-pig test was negative in 17.7 per cent of proved cases of renal

tuberculosis and positive in 18 per cent of kidneys that were thought to be normal mates to tuberculous kidneys. They agree with Medlar and Sasano that excretory bacillosis is negligible and attribute the positive findings to a possible ureteral "reflux."

Relative to the early symptoms of renal tuberculosis Beer (9) summarized 100 cases and found that nine to twelve months elapsed from the beginning of the typical symptom complex before the condition was diagnosed. It is more in males than females; more on right than left; nearly always hematogenous; begins in papillae and extends to pelvis, ureters, and bladder, sometimes causing stricture with resulting hydronephrosis and secondary infection. Runeberg (10) analyzes 213 cases of renal tuberculosis 123 of which had a nephrectomy. There were symptoms for more than a year in 55 per cent before tuberculosis was suspected. The symptoms were mostly of an insidious nature such as frequent urination; lumbar pain was much less frequent, and hematuria, pyuria, and emaciation were rare. Incidentally, he claims good operative results. Bugbee (11) points out that the insidious nature may be due to a low grade infection capable of healing without detection. This may help explain the "autonephrectomies" reported by Allemann (12), Wolff (13), Randall (14), and others. Joly (15) believes, however, that some so "called" spontaneous cures are due to a shutting off of the kidney by stricture but that the tuberculous focus persists. Fedoroff (16) describes an atypical form of tuberculosis of the kidney in which there is an inflammatory reaction without tubercle formation.

Recently it has been recognized that the initial infection may occur in the prostate and spread from that point. Keyes (17), Walker (18), Koll (19), Barney (20) and Crandon (21) are a few who have reported isolated tuberculosis of the prostate. MacKenzie and Seng (22) suggest that massive calcification of the prostate may be due to a calcified tuberculous lesion. Walker was able to find, however, but three acceptable cases in the literature, nevertheless Barney states the scarcity of such cases does not represent a true percentage but a "deplorable failure" on the part of surgeons to make proper examinations. Dillon

(23) reports a series of seminal tract tuberculosis and concludes that the initial lesion of such disease is more often in the pelvic glands than is generally conceded. Nitch (24) considers that the infection of the epididymis is most frequently secondary to an infection in the seminal tract or prostate because the oldest lesion is located in the globus minor and extends from there toward the testis. Primary deposits in the globus major, he states, are rare and perhaps always hematogenous.

Other clinical and pathological variations are not clearly defined or sufficiently systematized to be of use in applying therapeutic measures. For example, the question of ascending kidney infection is little understood, as is also the relation of hydronephrosis to renal tuberculosis. Regarding the former most authors consider that the ascending type of infection occurs occasionally but is not the rule. Hammond thinks that the second kidney is affected by ascending infection. Buerger (25), Oraison (26), Boeckel and Oberling (27) report cases appearing to be ascending infections. Greifenstein and Kehl (28) state that ascending infection occurs only in advanced tuberculosis of the bladder.

Hydronephrosis appears to be present in certain types of kidney tuberculosis. It is probably due to a ureteral stricture from a tuberculous process or associated infection. Cumming (29) has made a study of these concomitant conditions and divides the cases into four groups; first, unilateral involvement having hydronephrosis and tuberculosis; second, unilateral hydronephrosis in one kidney and tuberculosis in the opposite kidney; third, bilateral hydronephrosis and tuberculosis in one kidney; fourth, both conditions bilateral which are obviously hopeless.

Perhaps the most important is the rôle of prostatic involvement in genito-urinary tuberculosis. As mentioned above, authors are beginning to recognize its importance; but the relationship to the primary body lesion is not sufficiently understood. Neither do we know much of the relationship to kidney, bladder, ureteral and genital tuberculosis.

There is a definite trend recently to conservatism in the treat-

ment of tuberculosis of the genito-urinary apparatus. In spite of the favorable report of Runeberg who states that fully 80 per cent of the nephrotomized cases were restored to health, Young, Barney, Greifenstein and Kehl and others are more pessimistic. The proper follow-up study finds that the majority ultimately succumb to their tuberculosis. It is probable that there are many nephrectomies in bilateral disease, or in disease of other portions of the genito-urinary tract. Perhaps the absolute unilateral disease of the kidney or epididymis is not so common as thought or the diagnosis is made too late to forestall a spread to other parts of the genito-urinary tract after operation.

In the subsequent report we shall cite cases and chart the results of autopsy findings in a series of tuberculous individuals and from these draw what conclusions we may. In doing this we are aware that such data must be interpreted continuously, and conclusions drawn from the autopsies must apply only to patients *dying of pulmonary tuberculosis* few of which were other than pulmonary tuberculosis from the beginning.

In this study we have included 103 pairs of kidneys in male patients; 70 bladders; 50 lower genital organs of the male; 71 pairs of kidneys of the female and 64 bladders, tubes and ovaries. The discrepancies in the figures are due to the fact that proper sectioning was not done on certain organs. As it is the sectioning was done every 5 to 6 mm. and suspicious specimens were examined microscopically. This method is obviously not as complete as Medlar's (30) although the only difference will be in the relatively rare organs possessing isolated microscopic tubercles. In this type of tubercle we should expect to obtain a lower result than Medlar.

The tabulation of the autopsy findings follows.

In table 1 is one case of generalized miliary tuberculosis where the process was extended to both kidneys. Six other cases had miliary tubercles scattered through both kidneys that was not a part of a generalized tuberculosis but of a localized process. One patient had a unilateral hyperplastic process that is shown in figure 1. This will be described separately as will the bilateral ulcerative kidney involvement shown in figure 2.

TABLE 1

Men dying of advanced pulmonary tuberculosis

ORGAN	PATHOLOGY	NUMBER	PERCENTAGE
Pairs of kidneys		103	
	Generalized miliary (bilateral)	1	1.0
	Localized miliary (bilateral)	6	6.2
	Hyperplastic (unilateral)	1	1.0
	Ulcerative (1 unilateral and 1 bilateral)	2	2.0
	Total	10	10.3

TABLE 2

Men dying of advanced pulmonary tuberculosis

ORGAN	PATHOLOGY	NUMBER	PERCENTAGE
Prostate		70	
	Miliary and caseous nodular (2 primary, 3 secondary)	5	7.1
	Hyperplastic nodular (primary) (positive also in kidney)	1	1.4
	Total	6	8.5
	Primary in prostate alone	1	1.4
	Primary in prostate but secondary in vesicles, bladder and kidney	1	1.4
	Primary hyperplastic	1	1.4
	Total primary	3	4.2
	Secondary in prostate but primary in epididymis, vas, and vesicles	2	2.8
	Secondary in prostate but primary in epididymis, vas, and vesicles but also local miliary in kidneys	1	1.4
	Total	3	4.2

In table 2 are charted various forms of prostatic involvement. This makes a total of 8.5 per cent of all male cases posted. The

hyperplastic nodular is the same case as shown in figure 1. The primary tuberculosis in the prostate alone was an isolated nodular tubercle found in a terminal case of pulmonary tuberculosis. The other primary case shown in figures 2 and 3 will be given in the case summaries.

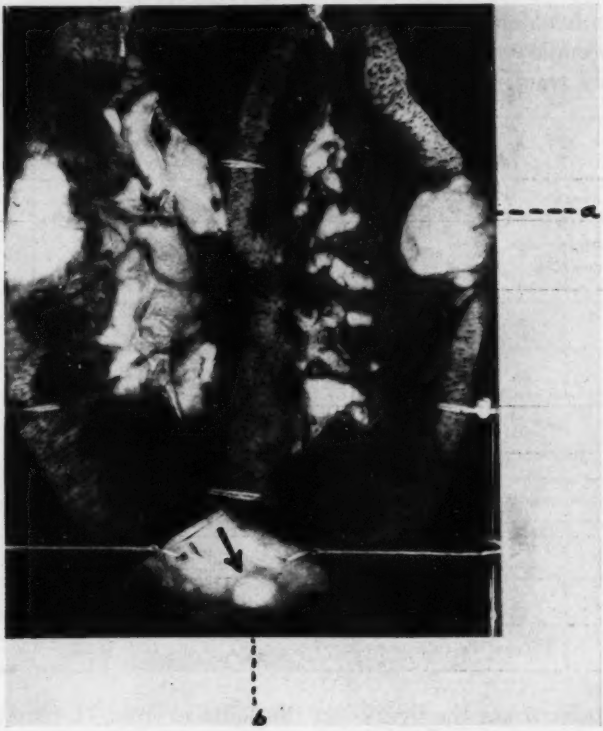

FIG. 1. HYPERPLASTIC OR LARGE NODULAR TYPE OF TUBERCULOSIS OF ONE KIDNEY AND THE PROSTATE (*b*)

Secondary involvement of the prostate perhaps occurs in all advanced disease of other parts of the genito-urinary tract. Figure 4 shows the extension of an advanced disease of the epididymis to vas, vesicles, and prostate. There is little question

about the prostatic lesion here being secondary because of its small size and relatively new formation.

In table 3 are charted the findings in the epididymis, vas, and vesicles. In the epididymis we believe exists one of the most common sites of infection of the genito-urinary tract, yet it may not be as exclusive here as is commonly thought.

The bladders shown in table 4 and in the females appeared to be secondary to involvement of other portions of the genito-urinary tract.

TABLE 3

Men dying of advanced pulmonary tuberculosis

ORGAN	PATHOLOGY	NUMBER	PERCENTAGE
Epididymis, vas, and vesicles		50	
	Primary caseous	4	8.0
	Secondary, primary in prostate	1	2.0
	Secondary in vesicles, primary in prostate	1	2.0
	Total	6	12.0

TABLE 4

Men dying of advanced pulmonary tuberculosis

ORGAN	PATHOLOGY	NUMBER	PERCENTAGE
Bladder		70	
	Ulcerative (all secondary)	3	4.3

In table 5 are the figures on the kidneys from 71 female patients. The kidney involvement is about the same in formation and type as in the male with the exception of miliary abscesses that were found in 5 cases. These, we feel, were very early tubercles that have not developed specific character. Why these should show more in females we cannot answer. The hyperplastic tuberculosis was in a colored woman having a disseminated nodular tuberculosis throughout (tuberculomas).

In table 6 besides the bladders, already mentioned, are the findings of the other female genital organs. Up to the present time we have had only one typical case of tuberculous endometritis. This is not included in the table but has been a recent

TABLE 5

Women dying of advanced pulmonary tuberculosis

ORGAN	PATHOLOGY	NUMBER	PERCENTAGE
Kidneys		71	
	Generalized miliary (bilateral)	1	1.4
	The terminal disease began from a ruptured nodular pyramidal tubercle that spread fan shaped to capsule and into peritoneal cavity.		
	Localized miliary (bilateral)	4	6.0
	Hyperplastic tuberculosis	1	1.4
	Total	6	8.8
	Miliary abscesses (possibly tuberculous)	5	7.0

TABLE 6

Women dying of advanced pulmonary tuberculosis

ORGAN	PATHOLOGY	NUMBER	PERCENTAGE
Bladder	Ulcerative	2	3.0
Uterus, tubes, ovaries		64	
	Generalized miliary (primary in kidney)	1	1.05
	Localized on serosa of peritoneum	1	1.05

finding. Table 6 only shows one case having a slight involvement of the endometrium, and another having a superficial miliary process on the peritoneal surface as the part of a generalized process.

CASE REPORTS

Case 1

A unilateral hyperplastic process in a white American having a disseminated large nodular tuberculosis (tuberculomas) in all the organs. The kidney and prostate are shown in figure 1. The characteristic picture microscopically is a diffuse epithelioid and fibrous infiltration with many granules and cocci present.

Case 2

C. P., No. 24732. The essential points of the history are that at the age of twelve, patient stated that he fell injuring his scrotum and penis. Five years later hematuria occurred lasting only half a day. The following year hematuria occurred again. Since then it has occurred about four times at irregular intervals. Last time was two days ago and was not accompanied by any pain.

Past history. Mumps six years ago followed by orchitis lasting three weeks. Usual childhood diseases. Veneral disease denied.

The autopsy revealed a completely atrophic right testicle, epididymis, and vas deferens. There was caseous tuberculosis of the right seminal vesicle and the right side of the prostate. There was a non-specific abscess in the prostate with marked hyperemia; there was a diffuse tuberculous involvement of the bladder causing coarse trabeculations with several miliary tuberculous nodules in the mucous membrane. The left kidney contained several large tuberculous ulcers in the calices but not in the parenchyma of the kidney. There was a markedly hypertrophic dilated ureter. The right kidney also had a dilated ureter. There was a moderate hydronephrosis present in the right kidney. An early inflammation of the pelvis was also present.

Microscopically there were very few patent tubules in the right testicle and epididymis. The majority were completely hyalinized. There was no tuberculosis. The right vas deferens was normal. The right seminal vesicle was caseous. The right side of the prostate was caseous with a few giant cells. There was a completely calcified tubercle present. A diffuse acute abscess was in the left side of the prostate. The left testicle, vas, and epididymis were normal. The left ureter was markedly dilated. This ureter and kidney were infiltrated with many polymorphs and lymphocytes. No giant cells could be found. The pelvis of the kidney was destroyed in the ab-

scessed portion and there was marked infiltration of the medulla by polymorphs and lymphocytes. No giant cells were present. The right kidney revealed a slight infiltration of the pelvis but no destruction of

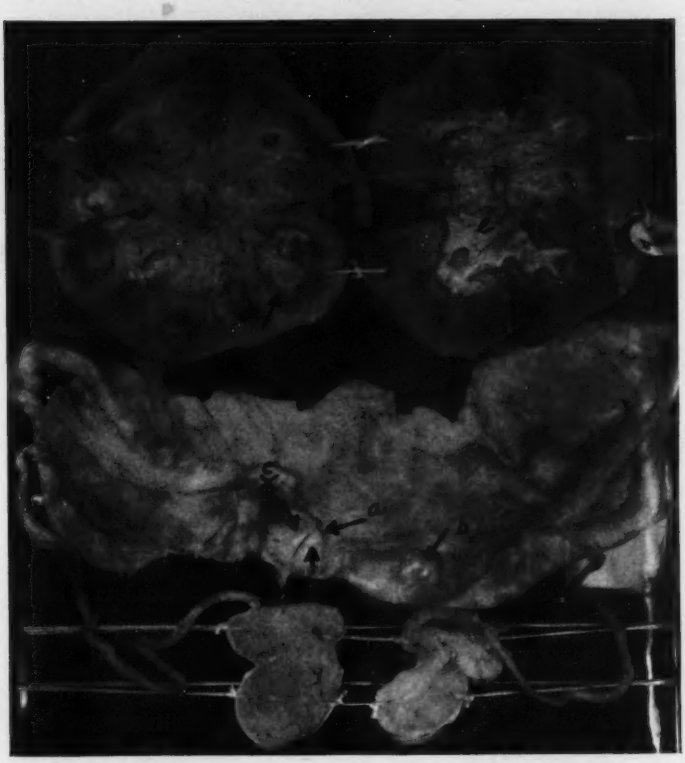

FIG. 2. PRIMARY GENITO-URINARY TRACT TUBERCULOSIS OF THE PROSTATE

Looking from the posterior part of the bladder. (*a*) Tuberculous prostate, right side. (*b*) Tuberculous seminal vesicle (right). (*c*) Non-specific abscess in prostate. (*d*) Ulcerative tuberculous lesion in left kidney. (*e*) Slight hydronephrosis in right kidney.

the epithelium. The reasons for assuming that there was a primary prostatic infection are as follows:

(1) There was a history of trauma followed by suspicious symptoms in the prostate region.

(2) There was the oldest appearing gross lesion in the prostate.

(3) There was a calcified tubercle in the prostate around which were caseated foci and giant cells, the only giant cells present in the whole genito-urinary system.

(4) The kidney infections were recent—left definitely tuberculous extending from the pelvis into the medulla; the right showing only early hydronephrosis and inflammatory changes not characteristic of tuberculosis.

(5) There was no tuberculosis below the vesicles.

A most important feature of this case is the fact that the pulmonary involvement seemed to be a very recent development without any calcified lesions. It is going too far, at present, to claim that tuberculosis was primary in the prostate. The primary lesion may have been in the lung with very slight involvement and the secondary lesion occurred in the prostate, then the terminal disease occurred in the lung. This case is being studied more exhaustively.

Case 3

April 8, 1925. A patient, Mrs. W., reported at the hospital at the suggestion of her physician for a dilatation of the left ureter. This patient had been dilated before and a complete physical examination made, including a bacteriological study of the urine and an injection of guinea-pigs, all of which were negative for tubercle bacilli. It may be added that the patient came to the hospital because she was suffering with pain on the left side, in the lower quadrant and had been relieved before by dilatation. She was dilated and secured relief of pain. Her relief continued until July 17, at which time she suffered an acute hematuria from the urinary bladder. She was suffering with excruciating pain on the left side and passing large quantities of blood. She was immediately taken to the hospital and everything done including a blood transfusion to stop the hemorrhage. A cystoscopy was made with an irrigating cystoscope and it was possible to see that blood was coming from the left ureter. The hemorrhage stopped temporarily but started after a few hours. The hemorrhage was controlled fairly well for the first twenty-four hours, once by leaving a catheter in the ureter for two and one-half hours. The urine was collected from both sides. The left side showed many tubercle bacilli while the right was straw colored and normal in appearance, and negative for tubercle bacilli.

FIG. 3. TUBERCULOUS PROSTATE SHOWING CHARACTERISTIC TUBERCULOUS INFILTRATION

Inasmuch as we were unable to control the hemorrhage and the fact that the other side was free from tubercle bacilli, there was no other choice than to do a nephrectomy on the left side. She was taken to

the operating room, the kidney was quickly removed under nitrous oxide gas anesthesia. The patient was again transfused but had a stormy convalescence.

Pathology. The kidney showed two tuberculous lesions in the superior pole, one had broken into the upper calices while the other lesion was about 0.5 cm. away from the pelvis of the kidney.

This patient never did make a complete recovery. Although her hemorrhage was completely controlled she developed meningitis and died October 12, 1925. The important point in this case is the fact that she developed a hematuria on the opposite side, ten days before her death, and on ureteral catheterization, showed many tubercle bacilli by direct smear on examination.

Conclusion. It seems to us that this case makes a very good illustration of what we have to contend with in making a diagnosis of unilateral renal tuberculosis. Here we were dealing with a case that had been handled by an excellent urologist before coming in. He had made all tests possible for renal tuberculosis including guinea pig inoculations and, as stated above, they were all negative. The pathology showed that she had a tuberculous left kidney, and while there was no question as to the choice of treatment, a nephrectomy was made, but the same condition soon made its appearance in the other kidney. This case reveals clearly the necessity for a close study of the opposite side or the so-called normal kidney. This confirms very well the work done by Braasch and others in which he found many cases suffering with a tuberculous lesion on the opposite side after its mate had been removed.

Case 4

Mr. G. entered the hospital February, 1927. He was sixty-four years of age and had all the symptoms of a patient suffering with a hypertrophied prostate. On rectal examination the prostate was large and smooth, presenting no nodules whatever. Cystoscopic examination showed the bladder to be normal with a few trabeculations present but otherwise was the bladder of a man suffering with an enlarged prostate. A blood chemistry was made and while the non-protein nitrogen was 46 and the rest of the blood chemistry correspondingly the same, and the centrifuged specimen showed no tubercle bacilli present, we decided to try a retention catheter for drainage.

It seems a little easier and better technic to do the operation with a

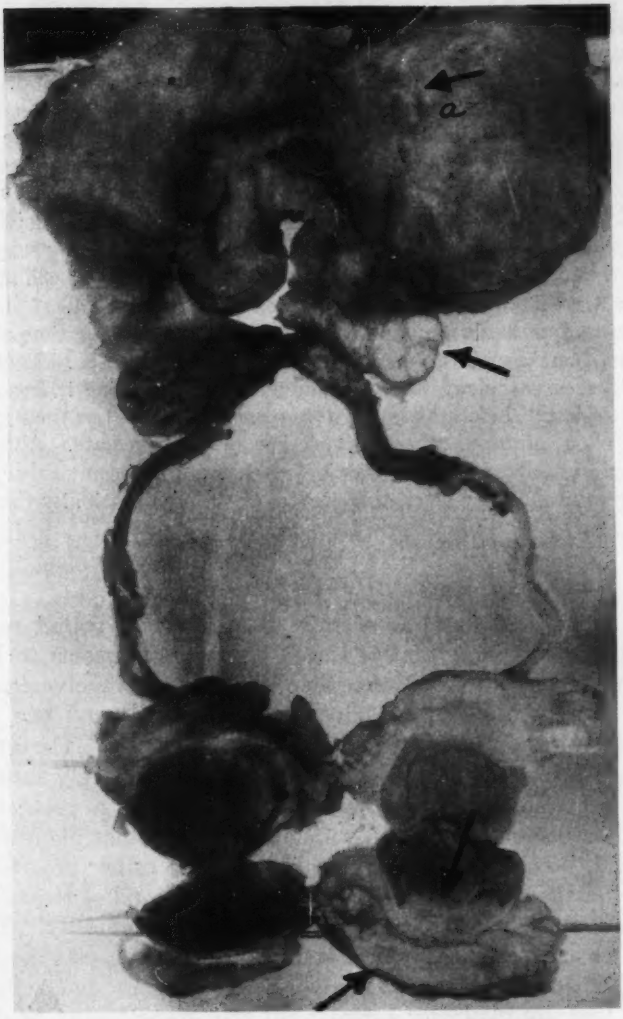

FIG. 4. PRIMARY GENITO-URINARY TRACT TUBERCULOSIS OF RIGHT EPIDIDYMIS, VAS, AND VESICLES WITH ULCER IN BLADDER AT (*a*)

one step than a two step operation providing the patient will tolerate a retained catheter as this patient did.

He was prepared in the usual manner such as forced fluids and was operated on, on the fourteenth day after entering the hospital. The prostate was easily removed except the most posterior portion which presented some difficulty owing to apparent adhesions. At the time of the operation it seemed that an error had been made and the patient was suffering with a malignancy of the prostate which was not recognized by palpation through the rectum or by cystoscopic examination. The sections were sent to the laboratory and we were greatly surprised to find that the prostate showed tuberculous lesions, as you will note in figure 3, a microphotograph of the prostate of this patient.

The patient made an uneventful recovery and up to the time of this writing, has shown no untoward results due to the operation. There are no signs of pathology in the epididymis and the urine is free from tubercle bacilli before and after the operation. This has the appearance of a primary tuberculous lesion of the prostate. Although clinical and laboratory examination reveal nothing in any other part of the genito-urinary tract, there is still the remote possibility that the lesion may have been elsewhere.

DISCUSSION

The principal features of this study may be stated rather briefly. Most important is the fact that there seems to be a sharp differentiation between the genito-urinary involvement as a terminal process to a pulmonary tuberculosis and one that manifests itself primarily in the genito-urinary tract. The former are nearly always miliary and bilateral and are rarely surgical. The hyperplastic types (those that accompany a generalized nodular tuberculosis) may be unilateral but are not likely to be surgical, because such type of tuberculosis is rather progressive at any stage and not easily amenable to any kind of treatment. The other group is the one of most importance surgically. They must be grouped into surgical and medical but this classification is a difficult problem clinically. There are no doubt many cases that are distinctly surgical but the surgery must be done at an opportune time and different for different types of disease. On them depends the success or failure.

It avails little to remove a kidney and leave a badly infected prostate to seed the opposite side, or to remove an epididymis and leave an infected seminal vesicle. Most of such lapses result in extension of the process. Not infrequently there occurs a tuberculous involvement of the epididymis in advanced pulmonary tuberculosis and still more rarely of the prostate. Either of these processes should be diagnosed early and removed by an operation sufficiently radical to remove all of the foci of infection, if at all.

The operation on the epididymis should be done before the spread reaches the vesicles, otherwise vasectomy and perhaps prostatectomy should be done. To leave an infected prostate means that the spread will continue to the other side and perhaps the kidney eventually.

There are also times when one kidney is removed with a supposed negative opposite kidney only to find that there is an enclosed caseous tubercle of the other side that ruptures later. Although a definitely established advanced unilateral tuberculosis of the kidney must be removed, it should be done only after a painstaking study of the other side.

We feel that tuberculosis of the prostate is more common than the literature would lead us to believe.

CONCLUSIONS

In a report on the autopsy findings of 174 patients dying of pulmonary tuberculosis, the genito-urinary findings reveal:

1. That 10.3 per cent male and 8.8 per cent female patients have kidney tuberculosis most of which is miliary, bilateral and inoperable.

2. Some unilateral kidney tuberculosis is part of a generalized disseminated large nodular tuberculosis and also inoperable.

3. No operable kidney lesions were found in patients dying of pulmonary tuberculosis.

4. Operable tuberculosis of the kidney is found more in patients having extra-pulmonary lesions or in patients with minor foci in the lungs.

5. Primary genito-urinary tract tuberculosis in the epididymis was present in 8.0 per cent of cases. This type is operable if done early and the extent of the operation depends on the spread of the disease to the other portion of the genito-urinary tract.

6. Primary tuberculosis of the prostate occurred in 4.2 per cent of these patients. The disease is perhaps more common than the reports indicate.

A clinical report is cited of what appeared to be a primary prostatic tuberculosis (referable to the genito-urinary tract.) A clinical report is also cited to show the risk entailed in removing a tuberculous kidney with a "negative" opposite kidney.

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DISCUSSION

Dr. H. G. Bugbee (New York): While we are waiting for Dr. McKenna, I would like to mention a case that came under my care some five years ago. This was a boy four years old who fell on a picket fence. A picket entered the rectum and penetrated the urethra. No exploration was made at the time. The child was kept flat on its abdomen, night and day, for five days, the bowels constipated and the fistula closed by itself with a good functional result.

Dr. W. A. Frontz (Baltimore): I should like to put on record a case which is quite similar to that reported by Dr. Barney. This patient, a boy of fifteen, was admitted to the clinic three years ago. There was an history of imperforate anus at birth which had been operated upon some hours later. Following this operation, for a period of fifteen years approximately, the patient had continued to pass large amounts of urine per rectum and occasional feces as well as gas per urethram. Some six months before admission, he had swallowed a tin whistle which in due season had reached the rectum, passed through the communication between the rectum and urethra and lodged at the penoscrotal junction. The family physician was consulted and made an incision just over the penoscrotal junction and extracted the whistle. Examination at the time of admission showed a persistent fistula of the pendulous urethra.

The findings on examination were quite similar to those of Dr. Barney. The anus was extremely patulous and it was apparent that if there were any internal sphincter present, it was a very poorly-developed one.

The rectourethral fistula was very successfully handled by the operation devised by Drs. Young and Stone, after which there was no difficulty in closing the pendulous urethral fistula. Functional result was excellent.

I might say that at operation we were unable to find any trace of internal sphincter muscle. The patient got excellent results in so far as his ability to retain feces was concerned, despite the fact that there was no anal sphincter present. By observing certain care as to his diet so that the stool is well-formed and by having bowel movements twice a day, there is no incontinence of feces.

Dr. J. D. BARNEY (Boston): I can not help saying a word about the very interesting specimens which Dr. McKenna has shown us and to insist with him upon the tremendous desirability and importance of studying more carefully than I think some of us do, the integrity of the second kidney in renal tuberculosis. I had occasion to look the matter up and reported it at a meeting of this Association, in Washington, either three or six years ago, in which I found that a tremendous number of cases had occurred where the frankly tuberculous kidney was taken out and where there was evidence that the second kidney was tuberculous at the time of operation. I can not give you the data just now, but I proved it to my satisfaction and I have seen cases since which have convinced me of that observation.

I think we can not be too careful and I acknowledge and agree that it is an extremely difficult thing to tell, even by repeated examination, whether the second kidney is tuberculous or whether there is a little nephritis, if you want to call it that, or irritation, from the presence of a tuberculous kidney on the opposite side.

In regard to one of those specimens which Dr. McKenna passed around. I was very much interested in the large specimen in the glass jar, where there was tuberculosis of one kidney and tuberculosis of the vesicles and prostate. I understood Dr. McKenna to suggest that the fact that the lesion in the prostate or vesicle was caseous might indicate that it antedated that in the kidney. I can not say this is not so in this case, but I can not help calling attention to the fact that the pathologists apparently agree that it is very difficult or impossible to state by the appearance of a tuberculous lesion its age; that is to say, one that is caseous may be much younger than one that is not caseous, so I do not think that really gives us definite information.

If I may just say one more word, Dr. Young's paper recalled to my mind a most extraordinary case we had, although it is not quite in the same category. A man came into the accident room not so long ago with a history that he had been in some kind of a brawl and had been pushed or thrown downstairs. In order to save himself, he made a grab at the banisters. These banisters were wood, about one inch in diameter and in some way or other the square blunt end of this banister had gone through his trousers, through his underclothes, up his rectum without injuring the sphincter to any extent, pushed a hole through his prostate and gone into his bladder.

I was not there at the time of the operation, but a simple suprapubic cystotomy was done for drainage and investigation and so on. His bladder was full of blood and this very large hole could be seen in the prostate just posterior to the prostate urethra, and if I am not mistaken, a finger in the rectum went right up into the badder. The bladder was drained and nothing else was done, thinking perhaps he would heal, and he did heal. He went home with a perfectly intact sphincter and a perfectly good urinary outfit.

Dr. HUGH H. YOUNG (Baltimore): I wish to thank Dr. McKenna for bringing these very interesting pathological specimens to our attention. I am particularly interested in the pathology of tuberculosis of the seminal tract which is herewith depicted. Some of his cases undoubtedly confirm our position that tuberculosis of the epididymis in a large percentage of the cases is accompanied by, if not preceded by, tuberculosis of the seminal vesicles and prostate. His case of isolated tuberculosis of the prostate is quite rare. I am glad he stressed the importance of studying the kidneys in all cases of seminal tract tuberculosis, because we have found that in 25 per cent of the cases, one kidney is involved. In a recent analysis of 22 cases, in which my radical operation for tuberculosis of the seminal tract had been carried out, it was necessary to perform nephrectomy in 27 per cent of the cases. I am more than ever convinced that many of these cases were only saved by carrying out radical operation. Had we been content to

do only castration or epididymectomy, many of these patients would not have survived long. Even where such extensive operations as nephrectomy, in addition to seminal vesiculectomy, partial prostatectomy, ampullectomy, vasectomy and epididymectomy were carried out, permanent results have been obtained in cases which have been followed as long as twelve years. Where the process is largely confined to the epididymis, it may be quite satisfactory to carry out simple epididymectomy and inject the vas deference with carbolic acid, and such is the procedure which we employ in early cases, but where the process in the seminal vesicles is very definite, particularly when the prostate is markedly involved, it seems very inadequate to attempt to treat these cases by epididymectomy, and my recent series of cases published in The Journal of Urology[1] proves conclusively, I think, that only by radical attack can such extensive tuberculous lesions be satisfactorily combated.

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HEMATOCELE OF THE EPIDIDYMIS

VINCENT J. O'CONOR

Chicago, Illinois

Case report

William B., white, aged twenty-six years, and single, consulted me on December 9, 1922. He stated that on August 5 he had stepped upon a stick while hunting and had suffered a glancing blow to the left scrotum. The pain in the left testis had been intense only for about five minutes and he continued an afternoon of hunting in the brush. Twelve hours after the blow he noted that the left scrotum was somewhat swollen and slightly tender, but stated that at the end of a week, while there was no pain, a swelling at the lower pole of the testis persisted. This was the size of a small English walnut. His impression was that this swelling partially subsided during the next two weeks. At any rate, it became much harder during the following month and did not begin to enlarge until early in November. During these two months he noted no symptoms except an occasional dull, dragging pain in the left spermatic cord. There were no genital or urinary symptoms. During the six weeks prior to my seeing him, he stated that the left scrotum had enlarged rather rapidly but without pain or tenderness, other than the above-mentioned.

The patient was a robust native of the Kentucky mountains and boasted that he could not remember ever being sick in his life. No history of venereal disease. General physical examination was normal. Blood count and urinalysis normal. Blood Wassermann negative on two occasions. Local examination revealed a very large left scrotum, the skin of which was smooth and not adherent to the underlying structures. Tracing the structures of the cord downward from the external ring, the cord was normal in size and consistency. There were two rounded swellings in the scrotum, rather tense but smooth testicular outline with globus major of epididymis distinctly palpable and normal in size. Adherent to the lower pole of the testis, and apparently involving this portion by hard fibrous attachments, was a mass about

the size of a major league baseball (i.e., 3 to 3½ inches in diameter) and of about the same consistency. The outlines were smooth, hard

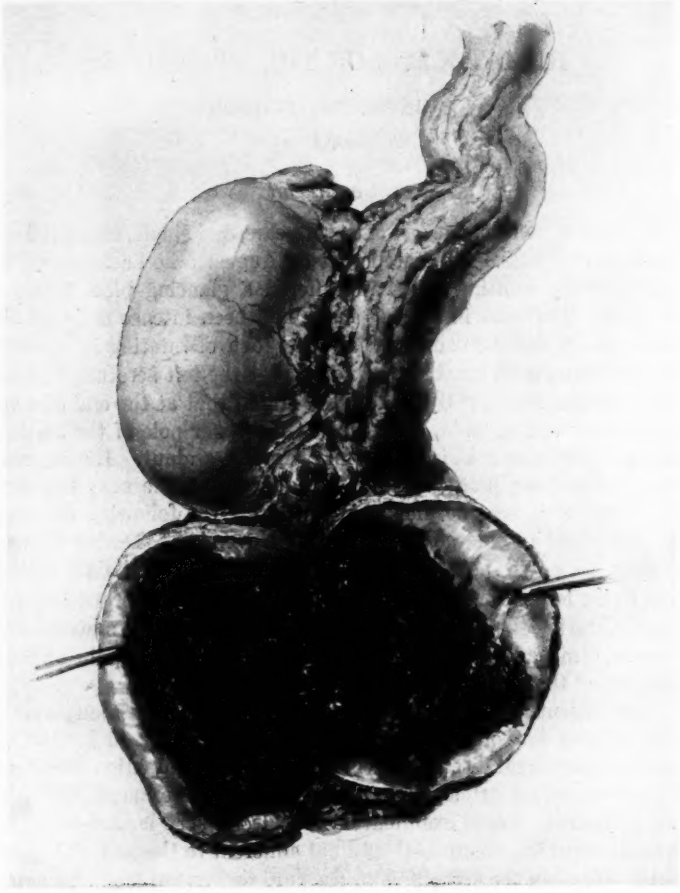

FIG. 1

and unyielding and fairly movable about the scrotal integument. There was no fluctuation, the mass was dull to light, and the physical findings were those of a solid tumor of the testis or epididymis. Be-

cause of the history and character of the mass a sarcomatous involvement was considered most likely. Operation was advised and accepted.

On December 14, under ether anesthesia a left inguinal incision was made and after ligating the cord at the internal ring, these structures were divided by cautery and the entire tumor mass removed without incision of the testis or surrounding structures. On gross examination the specimen presented a very hard tumor arising from the globus minor of the epididymis and not in any way involving the testis proper. The latter while somewhat enlarged, seemed normal in every respect. On section the wall of this tumor was almost cartilaginous in its density. Its thickness measured about 0.3 cm. and the central cavity was filled with a reddish to reddish-brown, thick, putty-like material which was intimately adherent to the walls. Gross appearance was very suggestive of a sarcoma with spontaneous central hemorrhage, although the clear-cut borders and character of cyst wall suggested a benign hemorrhagic cyst. The report of Dr. Bert Wolbach follows:

Gross description. Specimen consists of a testicle and spermatic cord. The testicle measures approximately 5.5 by 3.5 by 2.5 cm. and attached to its lower portion is an irregular, nodular swelling measuring 3.5 cm. in diameter. On section the nodular area consists of a very much thickened cyst wall measuring 0.3 cm. in thickness. This enclosed dark red, clotted blood. It is evidently a hematocele involving the globus minor of the epididymis. The tubules of the globus major contain dark red clotted blood. The testis on section is greyish white and the tubules apparently thread out in the usual manner. Section of the vas shows the lumen somewhat obliterated by blood clot. Sections are taken for microscopic study. Fixed in Zenker.

Microscopic report. One section from the testicle shows the tunica vaginalis to be thickened. The tubules have their normal epithelial lining and the interstitial tissue is not thickened. There are no signs of inflammation. Sections from the epididymis show an old hemorrhage, evidenced by the presence of hemosiderin all over the section and a repair to the hemorrhage by connective tissue which is hyalinized. There are no sections showing the cord.

Diagnosis. Hemorrhage into the epididymis (old); normal testicle.

Sections removed from the wall of the cyst at the time of operation were reported upon by Dr. Mary Lincoln as follows:

Sections of the thickened portion of the wall showed bands of connective tissue. Extending in from the wall were strands of very

cellular fibrous tissue which was organizing the coagulated blood in the cyst. There was abundant blood pigment in the tissue especially near the coagulated blood.

Sections of the thinner portion of the wall showed the same connective tissue, but much less blood pigment.

Final diagnosis. Hematocele of the globus minor (left).

The patient made an uneventful operative recovery and has been seen frequently for the past five years. He is in perfect health and has had no further complaint.

DISCUSSION

A careful review of the more recent literature on tumors of the epididymis, including the reports of Hinman and Gibson, O'Neil, Eisenstaedt, Dew, Sakaguchi, and others, gives ample reference to solid tumors, both benign and malignant, but no mention is made of a hematocele or any other kind of an organized blood tumor of the epididymis proper. In a search of the older literature I have found references to only four instances that suggest a tumor similar to the one here reported. Two of these reports were not available for study. The references are those of Heydenreich in 1895 and Bodiou in 1903. Valence, in 1902, and Mastignon and Vennat, in 1904, report two instances of epididymal hematic cyst formation. In the discussion of the latter report Chavannaz stated that he had seen a similar case. An interesting side light though not strictly pertinent in this instance, is a notation in the textbook of Monod and Terrillon to the effect that, while in testicular traumatism, hemorrhage is usually abundant owing to rupture of the voluminous vessels found in the albuginea, the epididymis is never ruptured but undergoes severe alterations, which result in sanguinary foci in the head or tail of the organ after a violent traumatism. These authors also say that Kocher reported 2 cases in which hematocele of the testis appeared to be transformed into a sarcoma. In each of these cases the hematocele apparently occurred during the progress of a testicular tumor, a condition which we recognize as a common occurrence in this type of neoplasm.

CONCLUSIONS

The history and physical findings in this instance led to the diagnosis of a probable malignant tumor of the lower pole of the testis or epididymis. After removal and section, the gross appearance was not unlike a sarcoma, although microscopic study showed the pathology to be that of a hematocele of the globus minor.

A search of the literature suggests that this condition is exceedingly rare or else has not been considered worthy of mention in the discussion and classification of epididymal tumors.

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HEMATOMA IN THE SUBSTANCE OF THE EPIDIDYMIS

HENRY H. MORTON

An effusion of blood into the sac of the tunica vaginalis following a contusion or poor technique in aspirating a hydrocele is not at all uncommon. An effusion of blood into the tunica as a result of a rupture of the vessels in chronic disease of the sac is also not so infrequent. Hemorrhage into the parenchyma of the testicle itself, and especially into the substance of the epididymis is an extremely unusual condition, and is generally preceded by a direct blow or torsion of the testicle.

In connection with the etiology of hemorrhage into the substance of the epididymis, only a few cases are on record. Bryant relates a case where a blow on one of the testicles was followed by hemorrhage into its substance. Langton describes an effusion into the epididymis following a torsion of the testicle, while the epididymis was separated and twisted and constricted at its junction with the cord. Jacobson describes a patient with hemorrhage of the epididymis eight years after being tapped for hydrocele. Valence relates a similar case. Hochenegg in 332 cases examined, found 2 cysts of the epididymis, pea-sized, containing a bloody substance similar to that found in other hemorrhagic foci, evidently the residue of subalbugineal bleeding which had become encapsulated. He also found other specimens of cysts in the substance of the testicle filled with similar broken down altered blood clots. Hemorrhages which occur spontaneously into the body of the testicle or head of the epididymis are accounted for by Hamonic as originating in cysts developing from the Wolffian bodies, or blocking of a seminiferous tube with retention of its contents and subsequent rupture from a contusion, or otherwise, followed by hemorrhage around the cyst into the substance of the epididymis or testicle.

The following case would seem to fit into the etiological group of hemorrhages caused by torsion.

Edwin P., male, colored, aged forty-six. Born in British Guiana; lately lived in Barbados. Elevator operator. Patient entered St. Peter's Hospital, July 11, 1927. He was thin and not of very strong muscular structure. Fourteen years ago noticed swelling in both in-

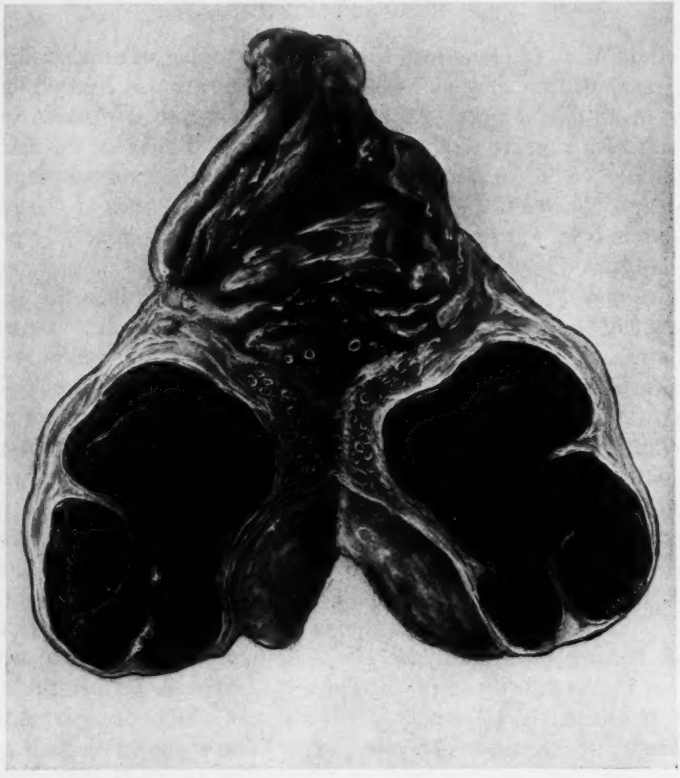

FIG. 1. SHOWING LARGE, FLACCID ANUS WITH MUCOSA OF ANTERIOR RECTAL WALL ACTING AS VALVE

guinal regions, and has worn a support since that time; has been able to work comfortably. While working in his elevator, the elevator jolted, and since that time the inguinal regions have been painful, especially the left side, and a scrotal tumor developed on the left side

and became larger. The impression of the physician who first examined him was that he had a bilateral inguinal hernia. On examination I found on the right side the testicle was normal in size with a moderate hydrocele of the cord and a large mass of varicose veins. On the left side, the entire testicle and epididymis were very much enlarged, and it was impossible to distinguish the epididymis from the body of the testicle, all being blended together. On the left side, the possibilities which occurred to us, after excluding hernia, that the enlargement of the testicle may have been due to syphilis, malignancy, or possibly tuberculosis. Syphilis was excluded by the Kahn test, which was negative, and the blood was also negative for filaria. As he had come from the Tropics we thought this condition should be considered. *Operation under ether.* On the *right* side, an incision through the scrotum disclosed a very large varicocele with pampiniform plexus of veins much dilated. A small hydrocele of the cord which was incised contained a dram of clear fluid. The pampiniform plexus was ligated in two places, and after first separating and leaving one vein for the return venous flow, the main plexus was cut between the ligatures. On the *left* side, after making an incision through the scrotum, the testicle was found to be very much enlarged and irregular, but moderately elastic on palpation. The pampiniform plexus was also dilated, forming a large varicocele.

We decided that castration was necessary. The spermatic cord was tied and cut off close to the external ring. The inguinal ring was exposed and closed after the Bassini method, and the wound sutured. The patient made an uneventful recovery and left the hospital in about three weeks.

Dr. Feinblatt, the pathologist, reports large hematoma in epididymis with small areas of necrosis. The wall of the tumor was made up of connective tissue, newly formed capillaries, and a few poly cells. Testicle normal.

As to the etiology of this case, in reviewing the history, we must conclude that there was a probable torsion of the testicle, with a twisting and blocking of the spermatic veins, when the elevator suddenly stopped. In an individual with normal scrotal veins, the interruption of the return circulation of blood would perhaps not have occurred, and the circulation would have been carried on as usual; but, with the existing dilated veins and poor

return circulation, a slight traumatism was sufficient to cause an obstruction to the return flow of venous blood, with back pressure and rupture of one of the veins in the epididymis.

We assumed that the hemorrhage took place on the *venous side of the circulation;* had the spermatic artery been occluded the entire testicle would have become necrotic; or, if one of the terminal arteries in the epididymis had been occluded, an infarct would have resulted. We must, therefore, by exclusion, come to the opinion that the large clot of blood in the epididymis was the result of twisting the dilated plexus of veins, interference with return flow of blood, causing back pressure and rupture of a small vein in the epididymis.

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SACRAL ANESTHESIA IN UROLOGY

A REPORT OF FIVE HUNDRED CASES

EDWIN DAVIS AND C. A. OWENS[1]

At the risk of presenting a subject with which all are familiar, and concerning which perhaps too much has been written in the past five years, we wish to briefly present a table summarizing the results of 500 cases of sacral or caudal anesthesia as applied to urological conditions. Our chief purpose is merely to direct attention to the ease of administration and freedom from complications of the simple caudal injection, and to point out the value of this method of anesthesia in such a simple procedure as cystoscopy.

Variations in the technique of employment of sacral or epidural anesthesia are such that a discussion of a given phase of the subject requires a definition of terms. The simplest and the most concisely descriptive term referring to the injection of novocaine solution into the sacral canal through one needle introduced through the sacral hiatus is "caudal anesthesia." The combination of this method with injection through needles introduced through the posterior sacral foramina upon either side (usually the first, second, third and fourth) is more properly described as "sacral block." It is unnecessary to add that the latter is merely a method of approaching the same nerves from different directions, in order to decrease the chances of unsatisfactory anesthesia as the result of incomplete infiltration.

Caudal anesthesia and sacral block, because of negligible risk and satisfactory results, have become recognized as of inestimable value in urology. Sacral block, although not quite so simply administered as is caudal anesthesia, has its advantage in being somewhat more dependable in major surgical procedures. This method is most satisfactorily applicable for perineal prostatectomy and (when combined with local infiltration anesthesia

[1] By invitation.

of the abdominal wall) for suprapubic prostatectomy, as well as for any major surgery of the bladder. Caudal anesthesia may be employed for any purpose requiring perineal incision, as well as for all forms of urethral instrumentation, including dilatation of stricture, removal of foreign body from bladder, fulguration of bladder tumor, and, finally, routine cystoscopic examination and ureteral catheterization.

As may be noted in table 1, the sacral block method has been employed in 181 cases, almost all of which (176) have been for perineal prostatectomy. Each of these cases received preliminary hypodermic injections of morphine, $\frac{1}{4}$ grain. The routine procedure has been to give approximately 40 cc. of 1 per cent novocaine into the sacral hiatus and approximately 10, 8, and 5 cc. of the same solution into the first, second and third sacral foramina upon either side, respectively. Many publications by different observers have called attention to the certain percentage of cases with inexplicable failure to obtain satisfactory anesthesia by this method. In this connection it is of interest to refer to former figures and to note that the percentage of failure materially decreases with practice in administration. In the original 30 cases of perineal prostatectomy by this method, which one of us reported in 1924, there were 7 cases or 23 per cent requiring auxiliary inhalation anesthesia. In the last 100 cases of prostatectomy by this method, only 3 cases required inhalation anesthesia and none of these occurred in the last 50. Failure to obtain satisfactory anesthesia therefore seems to be a matter of technique.

The simple caudal anesthesia may be very easily administered. In fact, in nine cases out of ten, the membrane over the sacral hiatus may be punctured and the sacral canal entered by the ordinary fine hypodermic needle as small as gauge 24, and $\frac{3}{4}$ inch in length. The customary technique has been to produce a subcutaneous injection and to also place 3 or 4 cc. of 1 per cent novocaine solution in the sacral canal through this fine needle and to then use a longer spinal puncture needle (about gauge 19) in order to be sure that this solution is well distributed throughout the length of the sacral canal. It is entirely possible, however,

that the complete injection may be satisfactorily given through the hypodermic needle, although we have not run a series of cases in order to positively determine this point. For the average case of cystoscopy, approximately 20 cc. of 1 per cent novocaine solution has been used.

Table 1 indicates the various procedures for which this method of anesthesia has been employed. It is by no means our purpose to recommend this method of anesthesia as a routine procedure

TABLE 1

Sacral anesthesia in urology; summary of 500 cases

Sacral block anesthesia	181	
Prostatectomy		176
Drainage of prostatic abscess		4
Repair U.-R. fistula		1
Caudal anesthesia	318	
Cystoscopy and ureteral catheterization		265
Dilation of urethral stricture		24
Fulguration		15
Removal of foreign body		7
External urethrotomy		4
Litholapaxy		1
Cauterize caruncle		3
Total		500
Failure to enter hiatus		2
Complications		0
Reactions of consequence		0
Results in prostatectomy:		
Failure in first 30 cases		7
Failure in last 100 cases		3

in cystoscopy. This would, of course, be wholly unnecessary, particularly in the female. There are, however, certain cases of difficult cystoscopy on account of an acutely inflamed bladder, perhaps, or in the case of tuberculosis, where the success or the failure of our manipulations may depend upon the coöperation of the patient, which we may be wholly unable to obtain without anesthesia. All those doing cystoscopic work are aware that many such cases occur. Some of them are due merely to

nervousness and apprehension. In our experience, in many cases of simple observation cystoscopy, bladder spasm and limited capacity have been such that it has been impossible to obtain a view. These same patients, following the above described simple caudal injection, almost invariably become sufficiently relaxed to permit a good view and to give an opportunity for diagnosis otherwise impossible without general anesthesia. In addition to these cases, there are many cases of difficult ureteral catheterization and manipulation for ureteral calculus, to say nothing of cases requiring fulguration for bladder tumor and ulcer and the cases of calculus or other foreign bodies in the bladder to be removed via the urethral route.

Table 1 indicates two cases of complete failure to introduce the needle through the sacral canal, this probably being due to bony anomaly. In the entire series, there has been no mishap arising from the anesthesia. There has been the occasional temporary and transient reaction, characterized chiefly by pallor and perspiration and a moderate drop in blood pressure and sometimes by nausea and mild delirium, but there have been no complications or sequelae of consequence, nor has any one of these reactions been of sufficient degree to be alarming.

In conclusion, it may be stated that simple caudal anesthesia, using 20 cc. of 1 per cent novocaine through a fine needle, is a very valuable method of obtaining satisfactory results in cystoscopic manipulations and could probably be used with great satisfaction and far more extensively than it is at present in the average urological clinic. In view of the results shown on the accompanying table, it seems justifiable to advise the use of caudal anesthesia as a *semi* routine procedure for cystoscopy, particularly in the male. The value of the complete sacral block method in major surgical operations is well recognized.